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Editorial

SURVIVAL BEFORE PROGRESS

On September 11, the UN Atomic Energy Commission adopted, by a vote of ten to one (the U.S.S.R.; Poland abstained) its second report to the Security Council. This report follows closely the "Working Papers" reprinted in the last issue of the BULLETIN. It elaborates the various functions of the international control agency called for in the first report, but leaves the consideration of administrative and legal questions (including the veto) to a later time.

THE UN COMMISSION ADOPTS ITS SECOND REPORT

Simultaneously with the preparation of the "Working Papers" by the Control Committee, another Committee discussed the Soviet proposals. However, the majority refused to accept these proposals as an adequate basis for an alternative control plan, or to merge their discussion with that of the "Working Papers". The discussion of the "Soviet plan" thus still remains in an early inconclusive stage, illustrated by Gromyko's answers to the Cadogan questionnaire, reprinted on page 303.

The main reason for this was that the Soviet Union delayed a full year before presenting concrete counter proposals to the original American plan. By the time such proposals were made on June 11, the opinion of the majority had consolidated around the main theses of the American plan, and they were loath to start work again, on the basis of an, as yet vague, Russian inspection plan.

PROPOSALS TO POSTPONE ATOMIC POWER

Mr. Gromyko asserted that the "Working Papers", although prepared by groups in which French, British, Canadian and even Polish experts took a leading role, were essentially identical with the original American plan. In this he was right—up to a point. Closer examination reveals a significant evolution in the thinking of the majority—a change to which the public reaction has not yet been fuily appraised.

The differences between the Lilienthal-Baruch proposals and the "Working Papers" are twofold. In the first place, the requirements of ownership, management and inspection have not only been spelled out in more detail than before, but have also been considerably extended and stiffened. In the second place, a shift has occurred in what may be called the fundamental philosophy of the plan.

To appreciate this change, one must go back to the early developments of the control ideas. The first document discussing international control, was the memorandum, submitted to the Secretary of War on June 11, 1945, one month before the first bomb test in New Mexico, by a committee of Chicago scientists, (BULLETIN Vol. 1, No. 10). The memorandum suggested: "The amounts of ore taken out of the ground could be controlled . . . and each nation allotted only an amount which would make large-scale separation of fissionable isotopes impossible . . ." This would make "impossible also the development of nuclear power for peacetime purposes. However, it need not prevent the production of radioactive isotopes . . . and would thus not eliminate the main benefits which nucleonics promises to bring to mankind."

The proposal to postpone the development of atomic power was repeated before the Senate Atomic Energy Commission by scientific witnesses such as Szilard and Urey. In the first article on the subject (in January 1946) the BULLETIN said that: "many scientists believe that this will be too great a sacrifice to pay for security against atomic warfare." The "Chicago Draft

Convention for the Control of Atomic Energy", also reprinted in the BULLETIN (Vol. 3, No. 8, April 1946) contained provisions for a five-year moratorium on large-scale production of fissionable materials.

ACHESON-LILIENTHAL REPORT —A CONSTRUCTIVE ALTERNATIVE

The Acheson-Lilienthal report approached the problem with an entirely different attitude: instead of restricting the production of fissionable materials, it suggested an all-out development under international sponsorship. By bringing nations together in a vast common effort of obvious advantage to all participants, the report hoped to overcome all incentives for breaking the agreement.

This hopeful and constructive approach caught the public imagination, and was supported even by those who previously discussed international control in terms of suspicion, inspection and punishment.

To many it appeared that such a centrally planned all-out industrial development would prove more acceptable to the Soviet Union than plans requiring the latter simply to submit to inspection by agents of the "capitalist" powers. Since then, however, the Soviet Union has refused to see in the constructive aspects of the American plan anything but attempts to create a worldwide, capitalist-dominated atomic energy "cartel", and has expressed preference for plans based on inspection alone.

In the meantime, the popular expectation of a millenium, to be brought about by atomic power, has given place to a more sober appraisal of what it may do for our economy. This has reduced the psychological resistance to proposals involving temporary renunciation of atomic power. The article by Daniel and Squires (BULLETIN, Vol. 3, No. 4-5) restated the case for this renunciation more cogently. In this issue, Professor Cavers gives a penetrating analysis of the difficulties which would arise if the original American plan actually were accepted by both the U.S. and the U.S.S.R., while world relations in general remained as they are now. He concludes that under these conditions, "dangerous" activities will remain dangerous even if carried out by an international agency.

"WORKING PAPERS" PLACE SECURITY FIRST

In the "Working Papers", we find considerable concessions to the same cautious point of view. The principle of mining and production *quotas* was introduced into the program and found noteworthy approval with the U.S.S.R. The papers leave no doubt that the quotas must establish not only a proper *ratio* of facilities and stockpiles located in various countries, but above all, reduce the absolute *size* of these stocks, so as to prevent the existence, anywhere in the world, of nuclear fuels in such quantities that their seizure could create a major international menace.

The paper on "Stockpiling, Production and Distribution of Nuclear Fuels" says: "There is conflict between the requirements of security and those of large-scale development and use of atomic energy for peaceful purposes. . . . If large quantities of nuclear fuel are produced . . . there will have to be, throughout the world, stockpiles of materials which could be readily used for a very large number of bombs. This would hardly be consistent with security. . . . It appears that at this time policy should be dictated primarily by security considerations. . . ." Obviously, by fixing the quotas at low enough figures, all development of atomic power in the world could be stopped —if it were decided that the maintenance of even a single atomic power plant will necessitate the production and stockpiling of atomic explosives in quantities such that their seizure may jeopardize security.

SCIENTIFIC FREEDOM VS. UNLIMITED TECHNOLOGICAL PROGRESS

The idea of establishing a "strategic balance" of atomic war potential on the "zero-zero-zero" basis rather than by means of some "100-100-80" ratio, giving each large nation access to an approximately equally big keg of atomic explosives, appears to many as "retrograde", "unscientific" or even "un-American", because it contradicts the traditional optimistic philosophy of technological progress. It has been said that it is strange to hear scientists advocate what seems to amount to a suppression of scientific progress.

This criticism, however, is based on the lack of discrimination between science and technology, typical of public opinion. As scientists, we believe that the urge to observe facts and search for the laws of nature, cannot be evil, since it is part of mankind's general striving for truth. We believe that the freedom of scientific investigation is fundamental. It should not be denied or abridged, any more than the freedoms of religion, opinion and expression.

No such fundamental value can, however, be conceded to technology. Its aim is improvement of material standards of life, and here, the only valid criterion is that of practical usefulness. If dangers inherent in a technological development appear to outweigh its probable contributions for good, no fundamental freedom is abridged and no basic tenets of our faith as scientists is violated, if this development is postponed or altogether abandoned.

We do not know whether the open suggestion of a "moratorium" on atomic power can facilitate an agreement with the U.S.S.R. A passing comment in the Moscow *New Times* has attributed such suggestions to vested power interests, fearing a new competitor. However, this renunciation would do away with the main present source of disagreement with the U.S.S.R.—the suggested international ownership and management of "dangerous" atomic energy activities—since no such activities would then be allowed at all.

We do not suggest that this proposal offers an easy way out of the present deadlock; but we think that it deserves calm and unprejudiced study and diplomatic exploration.

E. R.

ATOMIC POWER VERSUS WORLD SECURITY

David F. Cavers

While this article, begun in November 1946, was undergoing a series of revisions in response to comment and criticism from scientific sources, the BULLETIN published in its June 1947 issue an article by Cuthbert Daniel and Arthur M. Squires advancing substantially the same thesis. However, the authors of the respective articles emphasize different considerations in advocating the thesis they share. Professor of Law at Harvard University, Mr. Cavers is a member of the Cambridge Committee of Natural and Social Scientists which has been studying the use and control of atomic energy. During the war, he was Assistant and later Associate General Counsel for Price in O P A.

In pre-atomic discussions of disarmament, its advocates have been able to urge—and validly—that disarmament would increase security. To wage non-atomic war, a nation requires a vast aggregation of weapons and other material and, behind this, a huge organization, both military and technical. How time-consuming the preparations for such a war can be, is evidenced by the fact that it took Hitler's Germany nearly a decade to get ready, and, even under the whiplash of impending, and later of actual, hostilities, the United States required more than two years to build up its forces to a level which would sustain large-scale action. Even if a disarmament program allowed a nation to keep its armament factories in standby condition, it is evident that, before it could overrun another large nation, there would be ample time for the application of world pressures to restrain it.

PROPOSED SAFEGUARDS AGAINST SEIZURE INADEQUATE

What the atomic bomb has done is to destroy this assurance. The nuclear fuels needed for atomic power are pure or diluted atomic explosives. It has been proposed that the United Nations should create an authority to undertake the production of these nuclear fuels on a large scale. To the nation which seized atomic facilities from the United Nations authority, the elimination or substantial reduction of non-atomic armaments would merely give the assurance of freedom from interference in the execution of its plans.

"PROTECTIONS" AGAINST SEIZURE ANALYZED

How inadequate, in the absence of powerful non-atomic armaments, are the two proposed measures of protection against the dangers of seizure! They are, in brief:

(1) A "strategic balance" of facilities capable of producing atomic explosives. If a malevolent nation should seize the atomic facilities within its own territory, then the control authority could turn over its facilities elsewhere to the threatened nations.

(2) Production facilities and stocks of nuclear fuels should be so constructed and maintained that a seizing nation could not acquire enough atomic explosives to enable it to subject its victims to an immediate shower of atomic bombs.

The existence of the "strategic balance"—grimly revealing term—would only compel the seizing nation to take the precaution of sabotaging the atomic facilities in other nations. In accordance with the control plan, their staffs would almost certainly include the aggressor nation's own nationals or sympathizers. Given the advantage of surprise which an attacker enjoys, the likelihood of effective countersabotage would be slight.

The second of the precautionary measures poses two questions to which clear and reassuring answers have not been provided. First, if the control plan could prevent any substantial supply of atomic explosives from being exposed to seizure, how long would it take the seizing nation to equip itself for a large-scale or sustained atomic attack? Second, what protective action could be taken during that interval?

Before considering the timing of a large-scale atomic attack, it first should be noted that possibly no more than a few days would elapse before one or a few atomic bombs could be dropped. At least, we have not been assured that there would not be enough material at hand, at the moment of seizure, to make one bomb.

"Presumably no nation would think of starting a war with only one bomb," said Mr. Baruch. True, unless the nation possessing this bomb also possessed the only remaining facilities for producing atomic explosives. Then the fact that it had even one bomb available for immediate use would add importantly to its war potential. One well-placed bomb over Washington could literally decapitate the United States Government. And, after the one bomb had been dropped, the fear, however groundless, that the seizing nation had obtained, not one bomb, but several, might prove an even more effective weapon than the bomb itself.

THREAT OF ATOMIC WAR THREE MONTHS AFTER SEIZURE

After the seizing nation had used the immediately available atomic explosives—and perhaps plans could be devised to eliminate this hazard—how long would it then take that nation to produce atomic explosives in substantial quantities for military use?

Probably the most specific and authoritative answer is that supplied the UN Atomic Energy Commission by a committee of nine American scientists.[1] It says: "If only authorized facilities were in existence, it is esti-

1. See BULLETIN, Vol. 2, No. 11 and 12.

mated that from three months to one year would have to elapse after seizure of such facilities before a nation intent on making atomic weapons could produce a militarily significant number."

How many bombs the scientists regard as a "militarily significant number" is left uncertain. Nor does the estimate reveal whether the period might be shortened by the prior construction of secret facilities for making atomic bomb mechanisms, the detection of which has been conceded to be unlikely.

Faced by a range of "from three months to one year", those charged with planning for world security are not entitled to assume that any longer period than the minimum of this range would elapse. During that interval, in terms of defensive measures, obviously little could be done. Only the most careful advance planning and preparation could prevent a vast and disorderly exodus from heavily populated target areas, with possibly disastrous consequences to the threatened nation's war effort. Little could be achieved in relocating key war industries, in rehabilitating the sabotaged atomic facilities, or in creating new non-atomic armaments.

In those dread ninety days, whether the world would succumb to the aggressor nation would depend on the ability of the threatened nations, acting individually or collectively to wipe out the seized atomic facilities by the use of non-atomic armaments. If these armaments were not available in overwhelming numbers to press home an early counter-attack, the plight of the victim nations would be desperate. As they sought to rebuild their atomic facilities, the aggressor would be steadily replenishing his stock of atomic explosives. In the ensuing race, victory for the nation which had preserved its facilities would at the least be probable—for, in atomic warfare, the nation which can get its bombs there "fustest" will almost surely continue to have the "mostest."

LITTLE CHANCE TO IMPLEMENT PRESENT PLAN NOW

Given these considerations and the continuance of international tension, it seems impossible to hope for thorough-going disarmament so long as nuclear fuels are produced on a large scale. The interposition of management and even ownership by an international control agency over the production of nuclear fuels and, as is now proposed, over the source materials as they leave the mine or refinery, reduces, but does not remove, the hazard of seizure and early attack thereafter.

All this does not mean that the quest for world security is hopeless. The true basis of security is good will among nations. And today international good will is at low ebb—not unnaturally. The world has emerged from the ordeal of total war only to be confronted by a bewildering array of new and critical problems, most of which bring into conflict the two most powerful nations, the United States and Soviet Russia. An obvious and a minimum prerequisite to world security is the substitution of good will for the reciprocated distrust with which these nations now regard each other.

PRESENT PROPOSALS MAY PREVENT CONTROL AGREEMENT

This is not going to be a simple or a sudden achievement, and it cannot be furthered if each nation is to be exposed to the fear of atomic attack by the other, as would be the case if the proposals now before the United Nations were adopted. But there is still another danger which those proposals invite: the danger that no atomic control agreement whatever can be reached.

How genuine, how firmly fixed are the objections which the Russians have raised to the United States proposals, certainly no bystander can tell. It is noteworthy, however, that at a time when the Russians appear to have become somewhat more tolerant of plans for inspection by an international control agency, the experts of the UN Atomic Energy Commission have been losing confidence in inspection as a security device. The recently published "Working Papers" of the experts advocate a marked expansion in managerial and proprietary authority beyond what they had heretofore contemplated for the agency, despite the known opposition of the Russians to the vesting of any such authority in the agency.

This change of attitude by the UN experts is not, however, another manifestation of the 'get-tough-with Russia' spirit. These proposals for more rigorous controls, which will exacerbate existing disagreements, spring from a realization that previous plans were defective as a safeguard against seizure. And, unfortunately, the new proposals had to be accompanied by a candid recognition that they do not eliminate seizure as a danger nor would their effective execution in itself prevent atomic war.

WILL THE U. S. SENATE ACCEPT CONTROL PLAN?

Moreover the problem of achieving agreement on a control plan is not merely a matter of persuading the Russians to cooperate. Even if our representative pilots through the Security Council a control agreement which accords closely with the present proposals, the risk of its rejection by the United States Senate will be grave when the Senate puts two sets of facts together and casts a frightened glance at their sum.

The first of these two sets of facts is the one badly outlined at the beginning of this article. The Senate will come to learn why the creation of a UN authority with direct managerial control over the large-scale production of nuclear fuels cannot assure safety to this country.

The second set of facts would be called into being by compliance with the principle of "strategic balance" which would require the construction in Russia of huge facilities for the production of nuclear fuels. The designing of this project would certainly call for the application of American scientific and engineering skill; equipping it might depend on the participation of American industry; and financing it might possibly necessitate the aid of American capital. And though the facilities thus constructed would be operated under the direction of an international staff, doubtless composed in part of Americans and British, such comfort as the Senate might derive from that fact would certainly be impaired by the fact that the comparable facilities in this country would have to be operated under the direction of another international staff, doubtless composed in part of Russians and the nations of other Communist-dominated nations.

Given our present relations with Russia, is it unrealistic to suppose that more than one-third of the Sen-

ators voting would reject an agreement which presented those two sets of facts in combination? Would they not be more likely to cling instead to the vain and ultra-hazardous alternative of an atomic armament race?

Perhaps, however, another alternative might prove more acceptable to the Senate. This alternative would be to accept international control of atomic energy along the lines now proposed, but to insist on such protection as the aggregation of huge non-atomic armaments might give against the risk that any other nation would seize atomic facilities from the UN.

If the world did renew its non-atomic armaments race while forbidding atomic armaments, every nation would harbor the suspicion that the billions spent by its rivals for armaments had more than purely defensive objectives. And such suspicions would foster fear, that most potent of all stimuli to war in an atomic age.

MAINTENANCE OF "STRATEGIC BALANCE"—ANOTHER PROBLEM

Accentuating such fear would be the antagonisms which the efforts to establish and to administer an international agreement of the sort now proposed would almost certainly arouse. Among the most delicate and grave issues which the control authority would have to resolve would be those relating to the location of, and limits upon, atomic facilities and operations so as to achieve the desired "strategic balance." In this process the control authority would have to take into account not only the present pattern of international alignments but also the possibilities of change in that pattern.

To the problems of "strategic balance" would be added those of economic balance, a category which would reflect the repercussions that new power sources might have upon long-established economic relationships. Associated with these questions would be the difficulties involved in working out and applying suitable formulas for the capital financing of the authority's facilities and the terms on which its products would be supplied to public and private users.

As one surveys these difficulties in the context afforded by the present international scene, it is difficult to escape the conviction that few periods have been less propitious for the launching of so vast and delicate an experiment in the adjustment of conflicting national interests. The proposed control plan looks to international cooperation on a magnificent scale, but the opportunities it provides for creating new sources of international friction are comparable in magnitude.

AN ALTERNATIVE PLAN: POSTPONE ATOMIC POWER

If we want both security and disarmament, the agreement for the control of atomic energy need only prohibit, in addition to the use of atomic explosives for bombs, the existence of facilities for producing nuclear fuels in the quantities needed for industrial power. This prohibition would not have to continue indefinitely. The world would be on probation, and the reward of good behavior would be whatever benefits may flow from atomic power. The more pessimistic one is as to the time which would have to elapse before the ban could be lifted, the more certain he should be of the need to impose it.

To forbid facilities for what may be termed the "power uses" of atomic energy does not mean that great benefits could not still be derived from the discovery of nuclear fission. On the contrary, the uses of atomic energy in scientific and technological research and in medical research, diagnosis, and therapy would still remain open. Atomic research would be open to scientists in licensed private and governmental laboratories in all nations. It would constitute an important function of the international control authority. As is now proposed, the authority alone should have the right to investigate the military applications of atomic energy. Investigation into peaceful uses might be directed, among other ends, to the methods whereby atomic energy could most readily be used for industrial heat and power when the ban was lifted. At the present time it is clear that much work must be done before efficient use can be made of nuclear fuel. For a long time to come, the economic and social gains from the scientific and medical uses of atomic energy may be far more important than the power uses.

Why is it that so great a gain in security can be achieved by forbidding the facilities necessary for the power uses of atomic energy? The reason lies in the nature of the facilities themselves. As far as present scientific knowledge indicates, atomic energy can produce power only by "burning" one of the nuclear fuels (U235, U233, and plutonium). Nuclear fuels may be separated from uranium concentrates, as in the case of U235, by the processes of the sort used at our Oak Ridge plant, or synthesized from uranium or thorium, as in the case of plutonium and U233, by processes of the sort used at our Hanford plant.

If primary plants large enough to turn out atomic explosives in militarily significant quantities did not exist, then, as a practical matter, the risk of seizure would to all practical intents, be eliminated. But the only reason for such primary plants to exist—apart from bomb production—is to provide nuclear fuels for power purposes. No such plants are needed to produce fissionable materials in quantities sufficient to supply all the world's scientific and medical needs. The capacity of plants for these purposes would be so minuscule that there would be little or nothing of military consequence to be gained by their seizure, or by the seizure of the small-scale mines and refineries needed to supply them. That is why the only price the world need pay to escape the mortal hazard of seizure would be the prohibition of atomic facilities for power purposes.

NO TECHNICAL MEASURES CAN PREVENT SEIZURE

In the report of December 31, 1946, by the UN Atomic Energy Commission to the Security Council, covering the Commission's work from June 14, 1946, to the end of the year, the Commission declares: "Political and general considerations are paramount in the matter of safeguards against seizure. *No technical measures are likely to prevent seizure by a nation that has determined upon aggression and such measures as could be administered by an international control agency could hardly give complete satisfaction from the point of view of safety.*"

The italicized sentence deserves a rereading. In substance it concedes

that the world would have no adequate protection from seizure except the self-restraint of those nations in which the primary producing facilities are located. However, the report states that the Commission's consideration is "preliminary" and alludes to the possibility that there "may...be some measures of a technical nature which could be applied" and "which would assist in forestalling seizure and would tend to minimize the military advantages that an aggressor could expect from seizure."

The "Working Papers" disclose the results of further consideration of the seizure problem. Evidently that consideration was attended by anxiety, for anxiety seems to have fathered the principal departure from the December 1946 plan, namely, the proposal that the control agency monopolize ownership of source materials instead of simply relying on a power to inspect their extraction and preparation for use in reactors. By vesting the agency with the sole right to own source materials, the proposals would deprive producing nations of the right to accumulate surplus materials in stockpiles, ripe for seizure.

The "Working Papers" would thus correct a serious and an unnecessary defect in the December 1946 plan (although, as has been seen, this revision may further impede agreement). But the basic hazard to which the plan would expose the world is not removed by the revision. As the "Papers" concede: "The seizure of stockpiles, production facilities, and facilities utilizing nuclear fuel will always be a danger of such magnitude that seizure should be recognized by all nations to mean that a most serious violation of the treaty has taken place and that the nation is about to embark on atomic war." To meet this danger, the principal reliance of the experts continues to be placed on the balanced distribution of facilities, nuclear fuels, and necessary stockpiles, in other words, on "strategic balance."

ELIMINATING THE DANGER OF DIVERSION

The danger that a malevolent nation in which atomic facilities were situated might secretly divert a portion of the fissionable materials being processed and, in time, accumulate a militarily significant quantity of atomic explosives has thus far been ignored in this article. In other discussions of atomic energy control, attention has been focused on the diversion problem almost to the exclusion of the seizure problem. As increasingly effective measures are formulated to prevent diversion, the illusion might well become widespread that safety from atomic war had thereby been achieved.

RISK OF SEIZURE MAKES EVEN SMALL DIVERSIONS HAZARDOUS

The dangers incident to a relatively small-scale diversion of atomic explosives are sharply enhanced if the risk of seizure exists, and, at the same time, the dangers of seizure are also increased if there is a risk of such diversion. Suppose, for example, that leakages in the control mechanism permitted a nation to accumulate enough atomic explosives to make one bomb every two years. In six years, that nation would accumulate a store of three bombs. However terrible the effects of their use, three bombs would not, of course, suffice to sustain an aggressive war unless there were facilities with which to replenish the stock. But the fact that seizure of such facilities was possible would make diversion at that or a comparable rate a major hazard.

Again, the secret acquisition of three bombs would enhance the likelihood that the seizure would succeed. Since they could be used without warning immediately before the seizure, they could be so placed as to do the maximum damage to the victim nation's powers of retaliation.

Given these grim considerations, how serious does the diversion problem appear if nuclear fuels are to be provided and used on a large scale for power purposes? And what would be the hazard if power operations were forbidden?

The report of the UN Atomic Energy Commission of December 31, 1946, discloses the complexity and elaboration of the safeguards which would be necessary to minimize the risk of diversion if large-scale production of nuclear fuels were permitted. Close inspection and accounting would be required at every point from the mine yielding uranium or thorium ore to the power plant "burning" denatured nuclear fuel. These precautions would have to be reinforced by direct managerial control of the processes beginning with the conversion of the refined uranium and thorium into nuclear fuel and ending with the delivery of the denatured fuel to power plants. As has been noted, the recent "Working Papers" would now require this additional protection to begin with the extraction of source materials. Such precautions, to quote one United States report, would "assuredly prevent large-scale diversion of fissionable materials to atomic weapons for a number of years." Unfortunately, this report is obliged to qualify this impermanent assurance with the proviso "that the scale of authorized operations were low enough so that a small percentage diversion did not represent a serious military hazard."

Contrast with these hazards of diversion the situation that would exist if the power uses of atomic energy were forbidden and only facilities of a size needed to supply scientific and medical needs were allowed to exist. As to the risk of diversion from such facilities, the UN Commission finds: "Satisfactory safeguards in the case of small reactors for research purposes and their associated chemical plants could be provided by a system of licensing and periodic inspection by the international control agency." Such reactors, it adds, are "not capable of producing nuclear fuel at a rate significant for military purposes."

POWER BAN REDUCES CHANCE OF CLANDESTINE PRODUCTION

Although, as has been seen, the banning of atomic facilities for power purposes would reduce the hazards of seizure and diversion to negligible proportions, there would remain one danger to be guarded against: the clandestine construction of an integrated large-scale system for the production of atomic explosives.

The odds against success in such an undertaking would be long indeed. The report submitted to the State Department by the Board of Consultants headed by David E. Lilienthal flatly concludes that "the total effort needed to carry through from the mine to the bomb, a surreptitious program of atomic armament on a scale

sufficient to make it a threat or to make it a temptation to evasion, is so vast, and the number of separate difficult undertakings so hard to conceal, that the fact of this effort should be impossible to hide."

POWER BAN MAKES DETECTION OF SECRET ACTIVITIES EASIER

The possibility that a nation might seek to conceal its illegal activities by building smaller plants than those at Oak Ridge and Hanford has been reckoned with. In the report of the American scientists' committee, a reference to the possible resort to smaller plants was followed by the comment: "Nevertheless, if the Authority were familiar with the location of all large industrial establishments and knew their primary functions, it could be fairly sure that no dangerous unauthorized plants for the production of fissionable materials were in existence." And, in the UN Commission's December 31 report, it was noted that the subdivision of "certain operations in an effort to escape detection...would entail an increased number of installations."

It should be observed, however, that the possibility of seizing large-scale legal facilities would lessen the occasion to develop clandestine facilities on a large scale. For a sustained attack, an aggressor nation could count on the atomic explosives which, after an interval, would be supplied by the seized facilities. Therefore, the value of clandestine facilities to that ration would be simply to provide, over a period of years, enough atomic explosive to permit an initial attack to cripple its antagonists while production in the seized facilities was getting under way. On the other hand, the absence of large-scale legal facilities would compel such a nation to rely entirely on clandestine facilities. Therefore, these would have to be constructed on a large scale. And certainly the decrease in the difficulties of detection would be more than proportionate to the increase in the scale of the operations to be detected.

Another reason why a ban on large-scale nuclear fuel facilities would cut down the inspection task springs from the fact that the existence of such facilities would give rise in each industrial nation to a large-scale industrial development meeting the equipment and other supply needs of the atomic facilities. Similarly in each nation there would develop a relatively large scientific, engineering and technical personnel engaged, directly or indirectly, in work relating to atomic energy. Under cover of the normal activities of such industries and personnel much could be done to further clandestine preparations. To meet this risk, it would be necessary to step up the rigor and broaden the scope of the inspection process.

Still another reason why the existence of large-scale facilities would intensify the demands on the inspection process is the possibility it would afford of combining diversion of materials from legal facilities with the construction of clandestine facilities so as to minimize the extent of illegal construction needed for the production of atomic weapons. For example, if a method of diversion could be effected in the plants refining uranium or thorium, obviously it would not be necessary to open clandestine mines or construct clandestine concentration plants and refineries. Unless, therefore, it was completely certain that no such diversion were taking place, the inspectorate could not rely on their success in preventing secret mining or refining operations to justify any less comprehensive efforts to detect clandestine operations at later stages in the production of atomic weapons.

A final word with respect to clandestine operations. Any nation which determined to engage in these *on a large scale* would be compelled to expose itself over a long period of time to the serious risk of detection in an activity threatening the peace and safety of the rest of the world. The consequence of such detection might not be mere embarrassment; it might well be war, and that war might come before the wrong-doing nation had advanced far enough in its illicit activities to derive military advantage from them. In these circumstances, good behavior would be strongly rejnforced by national self-interest.

IS ATOMIC POWER WORTH THE RISK?

In this present period of tension among nations, the fact that so many people should now be calmly contemplating the large-scale production of fissionable materials simply to exploit the power uses of atomic energy would be astonishing to any observer who did not know the tremendous force which scientific discovery exerts on the imagination of modern man. Within three generations he has seen the genie of the laboratories perform miracle after miracle. Now comes the boldest, the most magical, of all these discoveries. The impulse to exploit the new revelation to the fullest is certainly understandable.

There is little evidence that the public or, indeed, many of its leaders, are aware of the great gain to security which would result from forbidding the power uses of atomic energy until relations of greater trust and amity have been established among nations or until scientific developments have minimized the hazards. This despite the fact that, early in the hearings before the Special Senate Committee on Atomic Energy, most of the points made in this article had been indicated in the testimony of several of the scientific witnesses. Among them were Dr. Harold C. Urey and Dr. Leo Szilard, distinguished University of Chicago physicists, and Dr. Irving Langmuir, associate director of General Electric's research laboratories.

CALCULATING THE COSTS

Many of the most exciting possibilities for scientific development which have been opened up by atomic research do not depend at all upon the large-scale production of nuclear fuels. The volume of radioactive material, which can be produced by a small-scale reactor maintained for scientific and medical purposes only, is tiny in absolute terms and in terms of military and power needs, but it represents a revolutionary expansion in the supply of such material that has heretofore been available for scientific and medical work. In a statement quoted in the report of the Lilienthal Board, a panel of nuclear scientists declared: "It is probable that the exploitation of atomic energy as a tool for research will outweigh the benefits to be derived from the availability of a new source of power."

Any calculation of the price which this country would have to pay by postponing atomic power would have to take into account two cost factors.

One of these is the cost of the temporary economic dislocations from the spreading use of nuclear fuels. The more rapid the spread, the greater the costs of dislocation to be offset.

The second cost factor would be reflected in the armament bill. How many more dollars would we pay out for non-atomic armaments if there were a huge plant porducing fissionable materials in Russia than we should pay if Russia's facilities were confined to a few laboratories and some small mines to supply them? I should be surprised if the difference did not exceed a billion dollars a year.

Having noted the costs to be offset, we can now ask the critical question: In return for putting our civilization in jeopardy, for creating new problems of economic readjustment, and for having to pay out a billion dollars or more in added armament costs, what rich reward do we get? Principally, it seems, a substitute for coal as a means of heating water to generate steam to drive turbines to produce electric power.

The limited effect of this substitution in terms of costs of electric power delivered to an average industrial or domestic user in the United States, and the considerable amount of research and development work which will have to be carried out before this substitution will become possible, have been analyzed in the BULLETIN on several occasions.[2] The fact that power generation constitutes only a fraction of the total cost of power delivered to the consumer, suffices to impose a severe restriction on the maximum possible savings to be derived from a new source of power.

INDUSTRIAL ADVANTAGES OF ATOMIC POWER LIMITED

Once the scientific and technical problems are solved, in areas where coal is costly because of low quality or high transportation costs, nuclear fuels may prove a more efficient source of heat in power generation. In this country, the areas where the advantages of nuclear fuels would be great are relatively unimportant; their power demands are low and are likely to remain such since they also lack many of the other essential factors of production, as, for example, an adequate labor supply and low costs for in-bound transportation of materials other than fuel and out-bound transportation of finished products.

Perhaps no industrial nation has a less evident need for nuclear fuels than the United States, with a supply of coal equal to its present power demands for the next fifteen centuries. Russia also seems well supplied. Moreover, like most of the remote areas in our own country, many of the nations lacking in fuel are also limited by the lack of other factors of production. Removal of their fuel handicap might only encourage these countries to launch uneconomic attempts at industrialization. From such attempts would spring a starveling brood of infant industries, protected by tariff barriers from the low-cost competition of more efficient nations. Certainly this country should be entitled to think twice before assuming "the whiteman's burden" in the peculiarly hazardous role of the purveyor of atomic energy for power.

1/4% TO 2% OF NATIONAL INCOME SAVED BY POWER USE

And is exposure to atomic bombing really a lesser evil than Britain's current coal mining difficulties? Not apparently in the view of Lord Cherwell, Oxford physicist who during the war held the post of personal Scientific Adviser to the Prime Minister. Lord Cherwell[3] calculated the total saving in national effort if atomic power could be used in place of coal, at 1¼%. In the BULLETIN OF THE ATOMIC SCIENTISTS (Vol. 2, No. 5 and 6) Professor Jacob Marschak, University of Chicago economist, placed these savings at from ¼% to 2% of our national income.

Is the chance of such a gain worth the running of the risks which have been surveyed in this article? In approaching that question, I suggest that the reader restate the issue in terms of a more personal hypothesis. Suppose that you, the reader, were offered an otherwise satisfactory employment in circumstances which gave rise to a real though statistically improbable danger that you and your family would be killed. Would you feel adequately compensated for that risk by the prospect that, over a period of years, your income might rise by perhaps as much as 5% above the level it otherwise would reach? Would even a sure and immediate increase of 5% tempt you? Double that amount? Treble? With your answers to these questions in mind, the significance of Lord Cherwell's and Professor Marschak's estimates can be better appraised.

To be sure there are opportunities for the long-range exploitation of atomic energy in industry which probably are not adequately reflected even in Professor Marschak's maximum figure. But these transcend the bounds of present scientific and technological knowledge. Their development will almost certainly require many years of research, both basic and applied. To forego the power uses of atomic energy while these studies are being pursued will doubtless delay their completion to some extent but important progress can surely be made. Moreover, in the interim, the carrying on of useful work will be less circumscribed by national fears and suspicions.

ATOMIC PLANTS HAVE ALREADY PAID FOR THEMSELVES

If the world were to forego the use of atomic energy for power, we would have to demolish all of the Oak Ridge and Hanford facilities except the small portion required for scientific and medical uses. These plants, which cost over a billion dollars, have already paid off in terms of the lives and dollars saved by the early ending of the Japanese War. It is probable that a very substantial portion of these facilities is now obsolescent, if not already obsolete. In any event, under a control plan, drastic changes in their design might be called for; perhaps a portion would have to be scrapped. Moreover, their cost is but a small percentage of the losses that we are calmly taking in the disposal of surplus war goods or of the sums that we would spend in seeking to protect them from attack. Nevertheless, some opposition to their demolition can be anticipated.

The opponents may argue that, since the power uses of atomic energy can-

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2. Vol. 2, No. 5 and 6, J. Marschak, "The Economic Aspects of Atomic Power"; Vol. 1, No. 7, "The Public Utilities and Atomic Power" (Testimony of John C. Parker before the Senate Committee); Vol. 3, No. 4-5, Cuthbert Daniel and Arthur M. Squires, "The International Control of Safe Atomic Energy"; and Vol. 3, No. 4-5, Sam H. Schurr, "Economic Aspects of Atomic Energy as a Source of Power."

3. BULLETIN, Vol. 3, No. 7, page 184.

IS THERE SOME HOPE FOR WORLD GOVERNMENT?

Glen H. Taylor

Two years ago the idea of world government introduced as a resolution to the Senate by Mr. Taylor, did not get support from any other senator. This year has seen the growth of a small but rigorous minority support of such a measure in both houses of Congress. Well known for his progressive views, the Democratic senator from Idaho needs no introduction to our readers. The text of his resolution introduced in the last session of Congress appears on page 304.

The basic problem which the development of modern science has placed before us is not a scientific problem, but a social and political one. Were it not that airplane, radio, and fast ocean travel has facilitated a rapid interchange of goods and ideas around the globe, we could remain happily isolationist without imperiling either ourselves or the rest of the world. But modern technology is responsible for binding the fortunes of our American way of life with the fortunes of cultures and political organizations which are vastly different from our own, and which also have yet to make their adjustments to the requirements of the modern world. We have the difficult job of reconciling such widely diverse systems as those of China, India, the U.S.S.R. and the United States within the structure of a single globe.

THE THREAT TO WORLD SECURITY

The development of the atomic bomb and other weapons of mass destruction, such as bacterial sprays, has served to aggravate this problem because we no longer have time to fight several more major wars before we come up with the answer. One more major war will most probably destroy all the contending social systems together with western civilization as we know it today.

The problem, I am convinced, is essentially one of security. Each nation wishes to be assured that its own national life and its own peculiar political institutions will continue. The people of each nation, observing other countries with vastly different systems, rightly sense that in this shrunken world those which are incompatible are certain to conflict. Each sees the other as a potential threat. The foreign offices of each take shortsighted steps to bolster their own security. These moves in turn appear to other nations as clear evidence of aggression. Retaliatory actions are taken in turn. Thus, fear breeds fear, and brings us dangerously close to the brink of what we all fear most: an atomic war.

WORLD GOVERNMENT THE ONLY WAY TO KEEP PEACE

The only way to reverse this drive to destruction is to build a world government sturdy enough to take over the job of keeping the peace. It must be empowered to take action against any aggressor—nation or individual. Such a government would need an armed force whose primary loyalty it would keep. It would require legislative, executive, and judicial branches similar to those of our own federal government. The difference would be that the supra-national government would be limited to the job of enforcing peace.

Admittedly, the danger of creating a gigantic tyranny is present. It is to be assumed that the peoples of the world will be at least as watchful—if not more watchful—of the acts of a supra-national government, as they are of their own national governments. Tyranny needs no system. It can spring up in any pattern and must be curbed in all. And the alternative to strengthening the United Nations is an atomic war which will certainly destroy whatever shreds of democracy we shall have retained after several years of an all-out armaments race.

This world agency, of course, would assume complete final jurisdiction over atomic energy as a war-making potential. I agree completely with Professor Harold C. Urey, who in writing for this magazine in June, outlined a program for handling the social problems created by the birth of atomic energy. The work of the Emergency Committee of Atomic Scientists is one of the brightest hopes in a darkening world situation.

We occasionally hear the thesis that scientists as technologists should not meddle in the field of government. This attitude is entirely misguided. Every citizen in a democracy must bear a share of the responsibility for government. Since the atomic scientists have provided the tools whereby our civilization may be destroyed, they as citizens have accepted the corollary responsibility to try to prevent catastrophe.

The voices of this nation's atomic scientists are being heard. More and more thinking people who have not concerned themselves previously with the awful problems posed to the world by scientific progress now are realizing our peril.

SOME PROGRESS MADE—BUT STILL A LONG WAY TO GO

There is still a long way to go before a majority either of the people or of the Congress understand what must be done. As I talk to groups all over the country I get the feeling that the people, however, are far ahead of their officials in government in realizing the need for action.

But even in Congress there are some slight grounds for optimism. The passage of the law creating the civilian atomic energy commission in this country was at least a beginning

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THE NATIONAL SCIENCE FOUNDATION BILL AND THE PRESIDENT'S VETO

Passed by Congress at its last session, the National Science Foundation Bill (S.526) was vetoed by President Truman. The following article summarizes the bill and the veto message.

Last year, a compromise National Science Foundation Bill passed the Senate, but died in a pigeonhole in the House because of renewed opposition of one party to the compromise —the group wary of too much government regulation of science. This year, a new bill, almost unanimously passed by both houses, was vetoed by the President, because it provided for an independent administration which did not fit into the usual set-up of government agencies.

SUMMARY OF THE BILL

The Bill S.526 provided for a Foundation of 24 part-time members appointed by the President with the consent of the Senate. Their compensation was to be $25 per diem. The National Academy of Sciences, and other scientific or educational organizations, were to make recommendations. The members were to be appointed for a 6-year term, and remain eligible for a second term. Some initial appointments were to be for shorter terms, to establish rotation.

The Foundation was to "formulate, develop and establish national policy for the promotion of basic research and education in the sciences", to "initiate and support basic research in mathematical, physical, medical, biological, engineering and other sciences", by contracts, grants, loans and other forms of assistance. It was enjoined from establishing its own laboratories or plants. The Foundation was to grant scholarships and fellowships and to foster worldwide interchange of scientific information. The establishment of special commissions for cancer, heart diseases, and poliomyelitis was prescribed, that for other research fields to be designated by the Foundation, authorized.

The Foundation was to meet not less than once a year; elect its own chairman and render annual reports to the President. It was to elect from its membership an Executive Committee for a two-year term, to exercise the powers and duties of the Foundation. This committee was to meet not less than six times a year. A Director was to be appointed by the Foundation, his powers and duties to be defined by the executive committee. His salary was to be $12,000.

Divisions of National Defense; of Medical Research; of Mathematical, Physical and Engineering Sciences; of Scientific Personnel and Education, and possibly other Divisions were to be established. The divisional committees were to consist of "not less than five" members to be appointed by the Foundation, not necessarily from among its members. The Committee for the Division of National Defense, was to consist of between 12 and 36 members, one-half representing the Foundation and one-half the armed forces, and to have its own Executive Committee.

The Foundation was to award scholarships for study or work in natural sciences or engineering, in American or foreign institutions of higher learning. Only American citizens were to be eligible, and the Foundation was instructed to distribute the scholarships as widely as possible among the individual States. The Foundation was to maintain a register of scientific and technical personnel.

Patent agreements "to protect public interest and the equities of the individual or organization with which the contract or arrangement is executed" were to be made with the contractors or recipients of loans or grants; however, these agreements should not alter in any way the provisions of the general patent law.

The Foundation was authorized to cooperate in international research activities, and assist scientists in attending international meetings.

An interdepartmental Committee on Science was to be established, with the Director of the Foundation as Chairman, and including heads or representatives of other Government agencies engaged in research. Its task was to gather and correlate data, and to prevent and eliminate unnecessary duplication of effort.

SUMMARY OF THE VETO MESSAGE

President Truman, in vetoing the Bill, described in a message dated August 6, his reasons for withholding approval. After expressing his deep regret for being forced to take this course, and repeating his endorsement of the idea of a National Science Foundation, the President proceeded to criticize the setup provided by the Bill, as "a marked departure from sound principles" of administration.

He stated that the Bill "would, in effect, vest the determination of vital national policies, the expenditure of large public funds, and the administration of important governmental functions in a group of individuals who would be essentially private citizens . . ."

He called "the organization prescribed in the bill complex and unwieldy . . ." and asserted that "Apart from the conflicts and confusion which would result from this complex organization, the bill would violate basic principles which make for responsible government:

"The Constitution places upon the President the responsibility for seeing that the laws are faithfully executed. In the administration of this law, however, he would be deprived of effective means for discharging his constitutional responsibility.

"Full governmental authority and responsibility would be placed in 24 part-time officers whom the President could not effectively hold responsible

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THE DEFICIENCIES OF THE NATIONAL SCIENCE FOUNDATION BILL

Don K. Price

The following article gives the arguments in favor of the President's veto of the National Science Foundation Bill (see page 290) and suggests the changes required for a "more suitable" program. The BULLETIN hopes to present the other side of the question in an early issue. Mr. Price is Associate Director of the Public Administration Clearing House. While on the staff of the Bureau of the Budget (1945-1946), he made studies of the problems of organizing and administering scientific research. He has been a member of the Social Science Research Council's Committee on the Relation of the Federal Government to Research.

The President's veto of S.526, Senator Smith's bill to create a National Science Foundation, was merely a necessary step toward the creation of a more suitable public agency for the encouragement and support of scientific research.

The great changes in our economic and political system during the past half-century—and even greater changes abroad—now make it necessary for the government to support the processes of scientific research on which the nature of our future society depends. The President has recognized this necessity by repeated recommendations, and the Congress by passing S.526 with little dissent from its major purpose. The enactment of some similar legislation during the next year or two may well be expected.

THE PRESIDENT'S VETO BROUGHT OUT CRUCIAL ISSUES

In vetoing S.526, the President brought out some of the crucial issues involved in the future relations of government to science—relations that may be as important to our society in the next few decades as were those a century or two ago between civil government and ecclesiastical or military power.

Let us consider some of the main issues that were involved in the Smith bill, S.526, and its predecessors.

These issues were first drawn clearly in 1945 when the Kilgore and Magnuson bills were introduced in the 79th Congress. Senator Kilgore, of course, had sponsored similar legislation for several years. In 1945, Dr. Vannevar Bush presented his report *(Science the Endless Frontier)* to the President, and Senator Magnuson introduced a bill based on its proposals.

ORGANIZATION CHIEF ISSUE IN FOUNDATION LEGISLATION

Both these bills were based on two main assumptions. It is important to emphasize this agreement because so much has been made of their differences.

First, they both assumed that the Federal Government, in addition to carrying on research through its various departments and in addition to any programs it might undertake in support of education, should encourage science by making contracts (or grants) for basic research with all types of private and public institutions. This meant that the agency set up for the purpose, rather than giving general subsidies to laboratories, should survey the whole field of science, and select those problems or fields of research, and those research workers or institutions, which with financial aid would make the greatest contribution to science.

Second, they both assumed that such a program would require the fullest use and development of sceintific talent. They agreed, therefore, in providing that the program should be developed with the advice and assistance of the best scientists available, and that part of the program should consist in the granting of scientific fellowships for the encouragement of research personnel.

But who should be responsible for the program? For what types of research should funds be granted? And who would own its results? These were the issues of (1) organization and administration, (2) the inclusion of the social sciences, and (3) patents.

Of these three issues, the most important was organization. It was the one on which compromise was most difficult in the 79th Congress, and on which the President vetoed the bill passed by the 80th. It was the crucial issue, of course, because to a great extent the other two depended on it. The Smith bill particularly dodged the other two issues by providing that the Foundation might support other sciences than those named in the bill, and by giving it almost unlimited discretion in its patent policy. This degree of discretion, of course, made the problem of organization and administration all the more obviously important.

526 DEPRIVES PRESIDENT OF ESSENTIAL POWERS

What, then, was the form of organization prescribed by the Smith bill?

First of all, the Smith bill went about as far as a Constitutional bill could go in creating an executive agency that would not in practice be effectively responsible to the President. It did so, of course, not directly, but by filtering responsibility through several layers of part-time, non-salaried officials. The President was required by the bill to appoint the 24 members of the Foundation for overlapping six-year terms (so that only two-thirds would be appointed during any one Presidential term), and was "requested" to consider nominations from the National Academy of Sciences and other educational and

scientific organizations—a request that might conceivably be supported by the Senate's advice and consent. The Foundation board, which was required to meet only annually, was to elect an executive committee of nine, which was empowered by the bill to exercise all the Foundation's powers. It would obviously not be possible for the President to exercise any effective authority over a board of 24 members meeting once a year, and the executive committee would have been responsible only to that board.

Second, the Smith bill proposed an organization which would have had no central focus of internal responsibility. The board or its executive committee was required to appoint a Director as its chief administrative officer, but the Director might have had little or no authority. The bill gave him only the power to appoint the employees of the Foundation itself; any other powers that he might exercise would have to be delegated by the executive committee. Moreover, the Foundation (and not the Director) was not only to establish its own divisions and determine their scope, but to elect as heads of those divisions miniature replicas of the Foundation board itself—part-time committees, which were given by the bill the authority to "perform the powers and duties" of their respective divisions.

ORGANIZATION PROPOSED BY S.526 LACKED COHERENCE

This arrangement pretty definitely made sure that the Foundation would not have a coherent program, but only a composite of several divisional programs, each reflecting the interests of its own specialists.

The Smith bill, however, added a few extra frills in the way of complicating the picture. The Committee for the Division of National Defense was to have 12, 24, or 36 members. These figures were to make it possible for the three secretaries of the armed services to designate half the committee members, and half the members of the executive committee of six. The Secretary of National Defense, like the President, was not to be given an opportunity to interfere with the special interests of his subordinates.

Then, although the Foundation was to have one Division of Medical Research and another of Biological Sciences, the bill directed it to establish one special commission on cancer research, one on heart disease, and one on poliomyelitis, each including six scientists and five "from the general public", to recommend a comprehensive research program in its field of interest and then "constantly to review the manner in which such program is being carried out."

In case the Foundation should want to give autonomous programs to other scientific specialties, it was to have power to create an unlimited number of such special commissions, and an unlimited number of divisions and divisional committees.

PREVIOUS BILLS SET UP WORKABLE ORGANIZATION

In this second respect—the destruction of the Foundation's internal coherence—the Smith bill differed sharply with both its predecessors, the Kilgore and Magnuson bills. The final Kilgore bill had been drafted in consultation with members of the President's staff agencies; it omitted a number of the overly-ambitious provisions of its earlier versions, and promised to be reasonably workable. Dr. Bush, whose report was the basis of the Magnuson bill, had received recommendations on organization as well as on program from the several special committees that he set up to advise him, but their recommendations on organization were so varied and so impractical that, on this aspect of the report, he prepared recommendations almost entirely of his own.

The result was that both the Kilgore and Magnuson bills, quite unlike the later Smith bill, proposed to establish in the Foundation a chief administrative officer, and give the organization some unity under him. The committee for each division would have had only advisory functions, and the Foundation board and its director or administrative officer would have had a much greater degree of leadership over the program as a whole.

The ways in which the Kilgore and Magnuson bills alike differed from the later Smith bill were probably more important—at least to the inner workings of the Foundation—than were the ways in which they differed from each other. For a basic purpose of the Foundation was to come to some kind of informed and integrated judgment—whether that of a board or a single administrator—on how an available quantity of money could best be spent. (We must assume, in all probability, that it will not be national policy to give every scientist all the money he wants to spend as he likes.) And any such judgment is certain to find itself opposed by a great variety of pressures, which will seek to have the funds distributed on the basis of specialized interests and influences.

This conflict would of course take place between the specialized divisional committees, on the one hand, and the executive director or top board on the other. A layman may suppose, for example, that some legitimate difference of opinion on policy might arise between a division on, say, medical science, and one on biological science. Perhaps the medical division would believe that research on cancer should be conducted mainly by physicians, while biologists would believe that fruitful research might be carried on by men of other types of experience and training.

S.526 INVITED ACADEMIC LOG-ROLLING

If some such disagreement should arise—the exact details do not matter—consider the situation under the Smith bill. Two divisional committees, each presumably made up of the most eminent men in their respective specialties, would dig in on their prepared positions. Their members would have been elected by the 24-member Foundaton board, and would be securely in control of their divisional programs under the terms of the statute. The members of the Foundation or its executive committee would have no sustained or full-time interest in overriding them. The Director, having no independent authority, would have little influence over them. The final program and budget would be made up by the executive committee, with each divisional committee standing fast by its position. And who would doubt that, under these circumstances, the budget would be made up more by a process of academic log-rolling than by the exercise of an informed and integrated judgment?

By contrast, under either the Magnuson or the Kilgore bill (or the compromise between them that passed the Senate in 1946, S.1850) the divisional committee members would have had only an advisory role. Moreover, under either the Kilgore bill or S.1850 the divisional committee members would have been appointed by the executive director of the Foundation to begin with—a process likely to put a somewhat higher premium on imagination and teamwork, and less on professional seniority, than election by a 24-member board. The director, with the help of divisional directors who would be his full-time subordinates, could make full use of the scientific judgment of the advisory committees, but would have discretion in preparing an integrated program, whether or not the top-level board would make the final decision before passing it on to the President and his Bureau of the Budget.

While obviously under the Magnuson or Kilgore bill there could be professional jealousy and disagreement, and under the Smith bill there could be good will and cooperation, it is quite obvious which type of organization would place a greater premium on influence and pressure, and which on a comprehensive view of the needs and opportunities of science. The rules of the game, in the long run, do make a difference in the way it is played; if you should move the pitcher's box closer to home plate, you could guess what would happen to batting averages.

OPINIONS DIFFER ON ADMINISTRATIVE SYSTEM

The Bush report and the Kilgore bill were in full agreement that the Science Foundation should have a coherent program, and that its head should be in a strong enough position to develop one. But they differed —and, as it turned out, irreconcilably —over the question of the relation of the Foundation to the rest of the government. The Magnuson bill (which was based on the Bush report) gave the Foundation board and its executive director enough authority to keep their divisions in harmony, but it denied the President enough authority to keep the Foundation in harmony with the rest of the Executive Branch. It did so by putting control of the Foundation in a part-time board, with power to elect its own executive director. By contrast the Kilgore bill made a single administrator, appointed by the President, responsible for the direction of the Foundation, but with the assistance of an advisory board.

It seemed at one time that the difference was not irreconcilable. The principal supporters of the two measures apparently agreed on a compromise, S.1850, which provided for a single administrator appointed by the President, but gave the advisory board enough status to insure it a measure of control, or at least substantial influence, over policy. The Senate passed this bill, but the apparent agreement evaporated when some of those who still preferred the Magnuson bill got Representative Mills to introduce a similar measure in the House, and testified in favor of it rather than of S.1850.

ARGUMENTS IN FAVOR OF A PART-TIME BOARD

What were the reasons or the arguments advanced in favor of putting the Foundation under the control of a part-time board rather than a single administrator? The principal ones, in rather oversimplified terms, were these three: (1) the best man won't work full time for the government; (2) science must not be regimented, for basic research cannot be planned and directed as were the wartime developments; and (3) science must be protected from political interference. These were the main arguments under which the compromise of S.1850 broke down, and which, when pushed almost to their logical conclusion, led to the provisions of the Smith bill. Thus the rationale of the leading supporters of the Magnuson bill led them a year or two later to support a quite different, and vastly inferior, measure.

This line of reasoning is by no means unique. It was the basis of the May-Johnson bill for the control of atomic energy; that too provided for direction by a part-time board. It is the basis for the demand for a part-time federal board of education to take over the U.S. Office of Education and related programs. It was the basis for those terms of the Hospital Construction Act which gave a part-time board, nominally advisory in nature, a large measure of control over a federal aid program. It is likely to be the justification whenever any important interest wants federal financial support without the obligations that go with it.

Now each of these three arguments, as stated, contains a large measure of truth. But even to the extent that this is so, they are not very relavant to the problem of organizing a National Science Foundation.

GOVERNMENT CAN ATTRACT ABLE MEN TO FULL-TIME JOBS

(1) The argument that the best men won't take full-time federal jobs carries the corollary that the remedy is to put a federal agency under the direction of a part-time board. It is also implied that the most able men, who would serve on a part-time executive board, would not waste their time in a merely advisory capacity.

Under present federal salary scales and personnel policies the government is obviously handicapped in competing for executive and scientific personnel. It has been able nevertheless to attract a considerable number of extremely able men into its service, largely because the jobs to be done by government are now the most challenging jobs in our society. The advocates of the May-Johnson bill predicted that the most competent men would not take full-time jobs as members of an Atomic Energy Commission. Yet it may be doubted whether the present members of the AEC, and its general manager, all of whom qualify by the most exacting standards, would have been willing to undertake their tremendous responsibilities on any other basis than full-time work and an exclusive devotion of their interest and energy.

If the National Science Foundation does the job it is meant to do, its program will be far more important than that of any industrial corporation or university in the country. The government of the United States cannot be run as a sideline by dollar-a-year men. If present salaries are too low, the remedy is to raise them, not to weaken the system of public responsibility.

And is it really true that eminent citizens will refuse to waste their

time on advisory boards? Some one should make a list, as evidence to the contrary, of the men who have served on advisory commissions in Washington during the past year—the President's Commission on Higher Education, another on Universal Training, and another on Civil Rights, as well as three or four advisory boards set up to appraise the effect of our foreign policies on our national resources and our economy, and various others established by the War and Navy Departments on everything from industrial mobilization to the writing of history. Even more pertinent is the experience of the General Advisory Committee to the Atomic Energy Commission, which has been an extremely influential board of eminent scientists.

In practice, the position as member of a part-time advisory board might be much more attractive than that as a part-time member of a board with full executive responsibility. The executive board, it must be remembered, has to defend its program and its budget in detail before Congressional committees. A president of a great university, for example, who was incidentally a member of the Science Foundation board, might be more reluctant to be quizzed by one of the more merciless Congressmen about grants made by that board to his own university—or about the general policy of giving grants to universities like his own, rather than to the A. & M. college of the Congressman's state. As a member of a board with merely an advisory function, he could make the same scientific contribution to the program without having to take the political heat.

ONLY SUSTAINED POLICY CAN PROTECT FREEDOM OF RESEARCH

(2) The argument that basic science requires more freedom than wartime scientific development seems obviously true, but hardly relevant to the problem. The Office of Scientific Research and Development regimented science, to the extent that it did so, not because Dr. Bush had full authority as its executive director, even though such authority might have been necessary for the purpose, but because the needs of war required regimentation. The OSRD experience, indeed, shows how a federal agency with a completely clear line of authority and responsibility can call to its assistance, without confusing that responsibility in any way, advisory boards of the most eminent scientists, and leave to them virtually all decisions involving scientific judgment.

The same type of organization in peacetime—that is, a director or administrator with full executive authority, supported by an advisory board of great influence—might be the most effective protection against the pressure for more applied and less basic research. This pressure to show immediate results in order to justify appropriations is certain to come from Congressional committees as they review each budget. The heads of private institutions which compete for grants will be all too likely to press in the same direction. That tendency can be resisted only by the sustained policy of the Foundation, supported by the organizations of scientists themselves. To defend such a policy, it seems probable that a full-time administrator, who could not be charged with having the interest of private institutions at heart, would be most effective.

THE PREVENTION OF POLITICAL INTERFERENCE

(3) The most curious of the three points is that the Foundation should be headed by a part-time board, rather than by a single administrator responsible to the President, in order to prevent political interference with the program.

There are, of course, two types of "political" interference. One is the general type of executive and legislative direction that is necessary to keep special interests of all kinds (the term "special interests" is not used here in any derogatory sense whatever) in harmony with each other and with general policy. Naturally no special or departmental interest likes this kind of political interference, but it is a sign of political maturity, and of confidence in responsible and democratic government, to admit its necessity.

The second type of political interference is the demand for changes in an agency's program in order to benefit some local or party or group interest at the expense of public policy. This type of interference has characteristically not come from the President, and in the nature of things it cannot come from the Congress as a whole. It comes, on the contrary, from individual members or committees of Congress, and from their alliances with executive bureaus or private pressure groups. It can best be prevented by Congressional action that provides for a proper measure of general executive discretion, and that holds the President accountable for carrying out a general program. Thus was the federal financial system generally freed from political interference, when the Congress put the budget system under Presidential direction. Thus was the federal personnel system generally freed from patronage by the Congressional adoption of the civil service system, and its steady extension by Presidential action. (It is worth remarking that the bureaus which were first freed from partisan patronage were generally those which required scientific qualifications.)

The decision in the 80th Congress to write a Science Foundation bill like S.526, putting the program in the hands of a part-time board and nullifying the President's Constitutional responsibility for its supervision, was not in response to the demands of scientists. On the contrary, the Inter-Society Committee for a National Science Foundation had taken a stand in favor of a more responsible form of organization, and so had the Federation of American Scientists. In effect, however, they and others were told that the Congress was not interested in their views on the organization of the Foundation. The passage of S.526 was a direct challenge to the President, by proposing to organize an executive agency for the granting of public funds in such a way that he could not effectively exercise his responsibility for its supervision.

THE PRESIDENT'S OBJECTION TO THE BILL

When the President refused to sign the bill, he pointed out that he had repeatedly recommended the establishment of a National Science Foundation, and summarized his objections. In brief, they were that (1) the bill provided an organization that would be complex and unwieldy; (2) it en-

(*Continued on Page* 310)

ITED NATIONS ATOMIC ENERGY NEWS

Peter Kihss

The BULLETIN is pleased to offer this first-hand report of events at Lake Success as a regular monthly feature. Mr. Kihss, a staff member of the NEW YORK HERALD TRIBUNE, has specialized in Atomic Energy Commission activities.

The full Atomic Energy Commission met September 10 and 11 and adopted the second report to the Security Council with ten nations in favor (Australia, Belgium, Brazil, Canada, China, Colombia, France, Syria, the United Kingdom and the United States). Russia voted no and Poland abstained. Last year, Russia and Poland had both abstained on the first report.

July 31: The *Control Committee* received from its coordinating group the revised version of six "Working Papers" (presented in condensed form in the September BULLETIN) as modified in the light of informal discussions in committee. It then decided to go into public session during the meetings at which these papers were formally discussed.

August 3: Frederick H. Osborn, American deputy representative, in an article for the *Washington Post's* atomic energy edition (reprinted elsewhere in this issue of the BULLETIN) criticized severely the Russian attitude in control negotiations.

FORMAL DISCUSSION OF SOVIET JUNE 11 PROPOSALS BEGUN

August 4: The *Working Committee*, with Captain Alvaro Alberto, of Brazil, taking over as chairman, agreed tentatively on a recess beginning August 15. Governments would be urged to submit views on the working papers by August 25. A drafting subcommittee—Canada, chairman; Australia, Belgium, France, the Soviet Union and the United States—was named to work on specific sections of the second report.

August 6: The *Control Committee* began formal discussion of the Soviet plan of June 11, excluding the veto issue. The United States, Australia, Belgium, Canada and China pronounced the plan inadequate.

OSBORN CONTRASTS SOVIET PLAN WITH "WORKING PAPERS"

Mr. Osborn said the Soviet proposals "add up to continued control of atomic energy along national lines, plus a form of limited inspection." He contrasted relevant portions with the "Working Papers":

1. Research. There is agreement on the need for agency research in the agency's own facilities, on fostering of full and constant exchange of information, and on agency aid to nations in research. But Soviet proposals "make no provision for control of national research or development activities of a dangerous character," which would be restricted to the international agency, according to the working paper proposals.

2. Location and mining of ores. The Soviet Union "fails to recognize the basic principle that only the international agency will use large quantities of source material," and makes no mention of a fundamental, positive agency function—"that of obtaining and maintaining as complete and accurate information as possible on world supplies of source material."

3. Processing and purification. The Soviet Union offers "no provisions for licensing or controlling any processing plant other than by unspecified inspection procedures."

4. Production and distribution of nuclear fuel. "I see no hope of reconciling the concept of an international agency performing positive functions of operation and management with the concept of nations performing the functions of operation and management and an agency attempting by inspection to meet the requirements of security."

5. Rights of and limitations on inspection. The Soviet statements are "only vague and general . . . the kind of inspection contemplated would seem to apply only to facilities which nations themselves reported to the international agency."

ZLOTOWSKI DEFENDS INSPECTION PLAN

Ignace Zlotowski, of Poland, demanded more efforts to reach agreement. The problem, he said, was to work out either "a supposedly ideal plan, which will interfere so greatly with an individual country's economic and political structure that many countries will not be in a position to accept it," or a less ideal plan which would be "practicable and acceptable to all nations."

"As for the Soviet Union proposals," Dr. Zlotowski added, "I freely agree that they present a general system which requires a number of changes and quite a number of important additions. It is a general plan as I understand it; it is not a detailed system of operation."

The Polish scientist observed that the Soviet document said nothing about national quotas, but "we have reached a unanimous informal agreement that such a quota system has to be established." He again challenged the "Working Papers'" insistence on international ownership, and quoted a Carnegie report which said that "the chief safeguard against not only the illicit use of atomic energy but all other dangerous developments in armaments is the provision for international inspection."

Dr. Zlotowski put his concept as follows: "The chief safeguard against the illicit use of atomic energy and all dangerous developments in the field of atomic weapons should be a system of strict international inspection of all stages of atomic energy produc-

tion, beginning with the mining of source material and ending with the final use of atomic power and the manufacture of radioactive power.

"The safest road to prevent future economic rivalries among nations in the field of atomic energy is to establish a system of national quotas for production, distribution and stockpiling of both source material and nuclear fuel, as well as for all dangerous facilities involving atomic material, especially the future atomic power plants.

"Finally, the only way to eradicate the dangerous dividing lines between the countries holding temporarily the exclusive know-how of atomic energy production and those countries ignorant of that skill—a situation which automatically leads to an atomic race in the world—is to restore complete freedom of atomic research in all countries as soon as possible, to re-establish free international exchange of scientific information in atomic research, and last but not least, to make sure that all countries are going to have enough atomic material soon to carry on nuclear research and to use already developed medical, agricultural and industrial applications of this new science."

RUSSIA WON'T ADAPT PROPOSALS TO U. S. PLAN—GROMYKO

August 8: The *Control Committee* heard Mr. Gromyko say the June 11 Soviet proposals were not intended as a "complete detailed plan," and assert that none of the Commission's proposals, so far, covered all questions. But he specified that the Soviet delegation "has not at all the intention to adapt its proposals to the provisions included in the proposals of the United States . . . providing for management, providing for the granting to the international organ the right of licensing, the right of ownership and so on." There was no need for such powers for the international agency, he said, and to the extent that the "Working Papers" were based on these proposals, the papers could not constitute a basis for a solution of the problem.

Meanwhile, Mr. Gromyko said it seemed to him that all were in favor of the establishment of an international control commission; no one had discussed the Soviet proposal that the commission be made up of the Security Council nations plus Canada, and no one had commented on the Soviet proposal for recruiting commission personnel "on an international basis."

The Soviet proposals also provided for investigating mining and production facilities and for accounting of atomic materials; for the commission to watch the observance of rules of technical exploitation prescribed in a control convention; for special investigations in case of suspected violation of the weapons ban; and for recommendations to the Security Council on the prevention and suppression of violations. Mr. Gromyko wanted to know if these were inacceptable, and why. He reaffirmed his belief that the Security Council's rights could neither be supplanted nor diminished, since they had been laid down by the charter.

FURTHER DISCUSSION OF SOVIET PROPOSALS

Richard T. G. Miles, of the United Kingdom, said the points listed by Mr. Gromyko as a basis for discussion had actually been discussed for months, and conclusions had been reached in the "Working Papers" in which the Soviet had not taken part. He said the Soviet proposals "do not go far enough." He then announced the United Kingdom government in London was preparing a questionnaire seeking clarification of the Soviet position, which it would ask the Soviet government to consider earnestly in the light of majority views.

Alberto Gonzalez Fernandez, of Colombia, said his government sought conciliation. "My delegation definitely intends to examine the Soviet Union proposal; if it is proved to us that it is better than the other proposals, we are going to support it." He disagreed with Soviet views on a separate convention outlawing atomic weapons; he did not think periodic inspection sufficient; he suggested considering nationalization of everything pertaining to atomic energy, and then placing the product of all national agencies "under the trusteeship of the international agency;" he insisted no veto should apply. He wished Mr. Gromyko would discuss his principles in relation to the concrete proposals of the working groups, and complained there seemed to be "a permanent parallel monologue—there is no dialogue."

August 10: In a statement written for the United Press (reprinted elsewhere in this issue of the BULLETIN), Mr. Gromyko replied to Mr. Osborn's August 3 article.

CLARIFICATION OF PROPOSALS SOUGHT

August 11: The *Control Committee* heard Francois de Rose, of France regret that Mr. Gromyko "did not reply constructively" to the opportunity to prove that Russia's June 11 proposals could guard against the dangers of diversion, clandestine activities and seizure, cited in the first report. The door remained open, particularly in view of the British questionnaire; the work was far from finished, and the French delegation did not believe the time ripe yet for political decisions on atomic energy.

Jamal el-Kourdajy, of Syria, said the "Working Papers" were the most complete and adequate documents yet presented. Points raised by the Soviet Union were contained in these documents, and he suggested the Soviet Union present its views as amendments to them.

Captain Alberto, of Brazil, said the Soviet plan would be among the least difficult to gain acceptance, since it required no great restriction on sovereignty, but "it does not seem to us to provide the safeguards which are the crucial test."

Mr. Gromyko said the Soviet favored thorough discussion of quota control, which might advance agreement. Soviet proposals provided for special investigation in case of suspected clandestine activities. Rules of technical exploitation "should be worked out and prescribed as obligatory ones to governments parties to the convention." Soviet proposals aimed at "establishment of international control and international inspection—not national control, national inspection." There were some questions on which there was "no substantial difference" between the "Working Papers" and the Soviet proposals, so he urged point-by-point consideration.

The United Kingdom submitted its questionnaire on the Soviet control plan.* In a covering letter, Sir Alexander Cadogan voiced the British government's hope "that your government might once again examine these questions, brought together for the first time as a single paper." Britain recognized that the June 11 Soviet proposals "contemplate a system of international control containing many important and novel features, when contrasted with proposals for international cooperation made in other fields than atomic energy." But it still felt Soviet proposals did not, "as they stand," meet "minimum requirements." Britain, nevertheless, had not taken a final view on what should be the essential features of an effective internationalization program.

MAJORITY VOTE AGAINST JUNE 11 PROPOSALS IN PRESENT FORM

August 13: When no one in the Control Committee sought to speak on the Soviet proposals, Captain Alberto, as chairman, suggested discussion might be closed. Professor Dmitri V. Skobeltsyn, of the Soviet Union, urged that the decision be deferred, and suggested discussion "could be perhaps prolonged more constructively when we would have given answers to questions received in writing." Mr. Osborn said the situation should be summarized, so that delegates could go about other business, leaving the way clear to new discussion when the projected elaboration took place.

George Ignatieff, of Canada, then offered a resolution which won support from the United States, China, Australia, the United Kingdom, Syria and Brazil. The resolution provided that the Soviet June 11 proposals "as they now stand, and the explanations given thereon, do not provide an adequate basis for the development by the committee of specific proposals for an effective system of international control of atomic energy. They therefore do not call for a change in the program of work of the committee, which was adopted on April 10. The committee notes that certain points in the Soviet proposals are not covered in the "Working Papers" so far submitted; these will be taken up in due course under the plan of work already adopted, as well as any new elaboration of the proposals already considered."

SOVIET AMENDMENTS TO FIRST REPORT DISCUSSED

August 15: The *Working Committee* received from the drafting sub-committee a summary of the discussion of Soviet amendments to the first report, and Syria obtained more time to consider it before action. The draft listed five "main questions of principle, raised by the U.S.S.R. amendments, on which no agreement has so far been reached:"

1. The reference to "veto" in the first report, and the implication of the phrase establishing the projected control agency "within the framework of the Security Council."
2. The safeguards required for strict international control.
3. The issue of one treaty or several, and in the latter case, the question of priorities.
4. The stages of transition to international control.
5. The right of the agency to conduct research in atomic weapons.

The *Control Committee* then met. Mr. Gromyko again appealed for paragraph-by-paragraph discussion of his June 11 proposals. He said the Canadian resolution would indicate that the commission has "two parallel lines which are running and do not merge at any point." He said any possibility of merging these lines should be explored.

Other delegates contended the resolution invited discussion whenever the Soviet further elaborated its proposals. On Mr. Osborn's insistence, a vote was taken, and the Canadian resolution carried by ten votes, all but those of Russia and Poland. No negatives or abstentions were called. Afterward, Mr. Miles said the Gromyko suggestion would have meant discussion "in two parallel lines," and now he hoped Soviet views would be put forward in the already-adopted framework of the committee's discussions. Canada and Brazil indorsed this view. Delegates then adjourned for their brief summer recess.

Aug. 27: The *Control Committee* formally took up the "Working Papers." Mr. Osborn called them "a group product," and listed the chief extensions of principle from the first report as (1) a plan of quotas to be written into the treaty, rather than left to agency discretion; (2) agency ownership of source material, nuclear fuel and dangerous facilities; (3) restriction of nuclear fuel production to actual needs; and (4) strict and careful limits on agency inspections.

On the research paper, Mr. Osborn said that "by throwing open the complete exchange of information, it provides the basis for the greatest advance possible in peacetime uses of atomic energy for medicine, industry and power."

DISCUSSION OF SECOND REPORT

Aug. 29: Mr. Gromyko told the Control Committee that the papers all derived from the basic American proposals, and so had "organic defects which can't be eliminated by formula." He asserted: (1) "They relegate to the background the basic problem—namely, prohibition of atomic weapons and other weapons of mass destruction;" (2) they seek monopoly for one country in atomic production, and "every statement by the United States convinces us that the view of the U.S.S.R. is correct," and (3) they are incompatible with fundamental charter principles and national sovereignty. Proposals for international ownership, management and licensing cannot be accepted, but the idea of quotas might be "a significant step in the matter of reaching agreement on international control."

Sept. 2: The *Control Committee* heard General McNaughton, as the new chairman, state that the Commission's duty was "to seek to narrow and make precise the areas of agreement and disagreement." He said the new report should indicate further work to be done, and plans for clarifying and seeking to resolve existing differences.

Dr. Zlotowski gave a detailed analysis of the six papers, and introduced his earlier-rejected alternatives as a dozen amendments to the research paper. In essence these would allow wide freedom of national research, subject to international safeguards when dangerous quantities of material were involved. He held international ownership unnecessary, and opposed

*See page 303 for British questions and Russian answers.

proposals for agency discretion on operating mines and mills as "an excellent way of planting all over the world the seeds of international conflicts."

On inspection, he suggested that the agency should always apply for any warrants first to a domestic source. In cases of obvious national non-cooperation, warrants should be "obtainable only from the Security Council itself or from an international body established within its framework." The proposal for periodic spot aerial surveys would raise the issue of flights over military reservations, and he did not see how governments could accept the right of free access to military facilities "until and unless there is an international agreement with regard to so-called conventional armaments."

Professor Skobeltsyn said the Soviet Union would not submit amendments to the papers because "the divergencies of principal nature are so great." He saw no use in submitting amendments "if representatives of the majority show no wish to seek a path, a means of coming to agreement."

MAJORITY WELCOMES U. S. RELEASE OF RADIOISOTOPES

Sept. 4: President Truman's release of radioisotopes for world biological and medical research, subject to publication of results and free access of scientists of all nationalities to the laboratories involved, won applause from ten foreign delegates. Professor Skobeltsyn remained silent. Ralph L. Harry, of Australia, told the Control Committee: "My government feels this is a clear answer to the critics who contended the United States was attempting to establish a monopoly in the world field of atomic energy . . . in a small way, it is on the same footing as the original unprecedented offer by the United States to give up the most powerful weapon known to men in the interest of humanity."

France, Brazil, Great Britain, Colombia, China, Poland, Belgium and Canada applauded the American move, and Syria's Wasef Kamal, a new delegate, told reporters later that he welcomed it. Dr. Zlotowski voiced the hope that the requested conditions would be fulfilled by the United States itself.

Sept. 5: Mr. Gromyko replied to the British questionnaire. (See page 303 for text.)

The Soviet reply was received with disappointment. It offered no new material, and, in fact, even ignored the idea of quota control which Mr. Gromyko had applauded.

APPROVE "WORKING PAPER" BY TEN TO ONE VOTE

Sept. 8: The *Control and Working Committees* both approved the six "Working Papers", with ten nations in favor; Russia and Poland both voted against all except the inspection paper, on which Russia voted no and Poland abstained. The Soviet reply to Britain's questionnaire was included in the second report, but not taken up in detail. Forty-three amendments, mostly drafting changes, were approved for the "Working Papers." Poland's research amendments were rejected, mustering only Dr. Zlokowski's vote.

Sept. 10: Mr. Gromyko, in harsh terms, attacked American good faith in the atomic negotiations. He charged that the Commission, in some respects, was losing ground as it is widening and not smoothing out existing differences of opinion, especially between the United States and the Soviet Union, on this important question.

Sept. 11: Mr. Osborn asserted that the Soviet Union from the beginning had "attempted to impede the desires of the majority to formulate specific proposals." He said there would be limitations to the work which could be usefully done" until the time when the Soviet Union accepted the views of a majority as to the functions and powers of the agency:"

The completed 105-page report summarized the 1947 proceedings and incorporated the six "Working Papers" as part II on "Operational and Developmental Functions of the International Control Agency," with little more than drafting changes from their earlier version (see BULLETIN Vol. 3, No. 9).

The introduction to the report said the specific proposals had been evolved from considerations advanced in the first report, and added: "They give expression to certain basic principles including:

"1. Decisions concerning the production and use of atomic energy should not be left in the hands of nations.

"2. Policies concerning the production and use of atomic energy which substantially affect world security should be governed by principles established in the treaty or convention which the agency would be obligated to carry out.

"3. Nations must undertake in the treaty or convention to grant the agency rights of inspection of any part of their territory, subject to appropriate procedural requirements and limitations.

"In implementing these principles, the following basic measures are provided:

"(a) Production quotas based on principles and policies specified in the treaty or convention;

"(b) Ownership by the agency of nuclear fuel and source material;

"(c) Ownership, management and operation by the agency of dangerous facilities;

"(d) Licensing by the agency of non-dangerous facilities to be operated by nations; and

"(e) Inspection by the agency to prevent or detect clandestine activities."

FUTURE WORK OF THE COMMISSION

The introduction listed for future discussion "the organization and administration of the agency, geographical location of dangerous activities and stockpiling, financial and budgetary organization, prohibitions and enforcement, and the stages of transition from the present situation to a system of international control."

"Clearly, much remains to be done before the final terms of a treaty or convention can be drafted," this section concluded. "The Commission intends to proceed with the remaining topics in the summary and, at the same time, will continue its endeavors to clarify and resolve where possible the existing points of disagreement."

THE RUSSIANS DELAY ACTION ON ATOMIC CONTROL

Frederick H. Osborn

This is a condensed version of the article by the Deputy representative of the United States on the UN Atomic Energy Commission, which appeared in the special Atomic Supplement of the WASHINGTON POST on August 3.

The almost complete deadlock which still exists with the Russians in the matter of the control of atomic energy is a dark cloud hanging over all our hopes for a better world. On Dec. 30, 1946, after the most prolonged discussion, ten nations voted for the report of the Atomic Energy Commission. Two nations, Russia and Poland, abstained from voting. For a while there were indications that there might be some points of agreement and that starting with these an acceptable treaty might be arrived at.

MARCH 7, THE FIRST CRUCIAL DELAY

Then on March 7 of this year Mr. Andrei A. Gromyko, in the meeting of the Security Council, blasted these hopes. He made it clear that every aspect of the Commission's report was unacceptable to the Soviet Union. He offered again as his alternative the Russian proposal; the United States should destroy its bombs and bomb assembly plants, and make public all its information on a gentlemen's agreement that no one would engage in an atomic war; thereafter, all nations could start on an even basis to discuss a treaty or convention which would define the way in which the gentlemen's agreement could be made effective and binding.

In the long debates held last year it was abundantly made clear that such a proposal was not acceptable to the ten nations on the Atomic Energy Commission, but the Soviets continue to press for their original demand. The year-end report after being considered by the Security Council, was returned to the Atomic Energy Commission with instructions to continue the attempts to iron out the differences with the Soviet Union, and at the same time to proceed with the drafting of specific proposals. For almost four months the Atomic Energy Commission has been laboring at these two tasks.

In one of their committees, by means of informal conversations and the diligent work of informal sub-committees, there have been drafted preliminary working papers setting up in some detail the functions of the proposed international agency for the control of atomic energy. All the nations represented on the Commission have had members on one or more of these sub-committees with the exception of the Soviet Union. The Soviet representatives have sat in as "observers." The chairmen or leaders of these groups have been respectively, French, Canadian, British, American and Chinese.

It was hoped that the representatives of the Soviet Union would take some part in the drafting of these preliminary papers, but at the very first meetings they announced that since they disagreed altogether with the report of the Commission of Dec. 30, 1946, they would take no part in drafting further proposals but would sit in these conversations only as observers. They have consistently adhered to this principle, and yet it is interesting to note a rather strange anomaly: the Soviet representatives sitting as observers in these meetings have actually taken more time of the meetings in raising questions of procedure and form than any of the other delegations have taken on the actual discussion of the work involved.

In another committee, the so-called Working Committee, an attempt is being continued to iron out differences in principle with the Soviet Union. The Soviet Union has offered twelve amendments to the Commission report. These amendments contain four very important disagreements in principle. Already more than a dozen meetings of the Working Committee have been devoted to this discussion. But to date there has been very little agreement on anything and not even any better understanding of what the Soviets really want.

Almost all of the time of the Working Committee has been spent either on arguments as to procedure, raised by the representatives of the Soviet Union or of Poland, or on an attempt to find out what was the meaning of the Soviet amendments. The language of each of these amendments is so far from clear that they mean different things to different people, and when the Russians are asked what the amendments mean they almost invariably reply that the meaning is perfectly clear and they see no reason to be drawn into an argument about it.

SOVIET FEAR INTERFERENCE WITH THEIR ECONOMY

The Soviet Union states that they are afraid that under such a treaty as is proposed, the economic life of their nation might be interfered with by a hostile majority in control of the atomic energy agency. Such a fear is very naturally in the minds of every nation trying to work out the terms of a treaty. Times change and what might be a majority unfavorable to the Soviet at one time, might be unfavorable to some other nation at another time. To meet this objection, the working papers propose that the general plan for the strategic balance of atomic materials and facilities be written in to the treaty so that the Agency will have no arbitrary powers. The Soviets have shown interest in this proposal. The

treaty must be so written that every nation shall be protected from every sort of inequity, and have the right of appeal whenever it thinks it is not being fairly treated. The Soviets say that they prefer control by inspection to control by the actual management and operation of all dangerous plants by the international agency itself. But control by inspection would be much more likely to interfere with the economic life of a nation than would control by operation under an international agency of all dangerous plants.

The Soviet Union states that a treaty such as that proposed would violate their national sovereignty. If it did, it would to the same extent violate the national sovereignty of every other nation, just as limits are set on our sovereignty by the very act of joining the United Nations.

RUSSIANS DON'T REALIZE SIGNIFICANCE OF ATOM BOMB

These objections are just those that are made by those who do not recognize the new and dreadful nature of the atomic weapon. The representatives of the Soviet Union constantly speak of it as though it were only one more form of explosive to be used in a war. This is a dangerous misapprehension. It is a tool which in the hands of a people engaged in a bitter war might wipe out civilization, or even humanity itself. There has never been anything like it before in the history of mankind.

Because the delegates of ten nations are conscious of this terrible danger they agreed on the principle embodied in the first drafts for the functions of the international agency —operation of all dangerous facilities by the agency itself so as to prevent national rivalries in this dangerous field.

The greatest confusion of all seems to be on the matter of the veto. Our stand is unmistakable. There shall be no veto on the quick and sure punishment of violators, no veto on inspection, no veto on the stages by which the treaty goes into effect. The Russians say that the veto must apply, but they don't say to what it must apply. They apparently insist that the veto must remain to protect violators from punishment. They have said that they do not require that there shall be a veto on "day to day" activities, but "day to day" activities have not been defined. Would some types of inspection be considered outside of "day to day" activities, and hence subject to veto? It is hard to find out, because the Soviet Union delegates are given no powers to negotiate. They seem to have to go back to the Kremlin to get permission to answer even the simplest questions. Such a system makes for infinite delays.

During June a number of the nations developed the idea that the strategic balance of materials and facilities, that is to say, the general over-all plan for quotas between nations, should be written into the treaty, so that the agency would act only within the limits set by the treaty itself. The Soviet delegates seemed impressed with the idea. A careful review of their statements in the past three weeks gives a few indications that they are at least trying to understand what is going on. They have been impressed with the fairness and protection offered by this idea of international quotas. They have apparently been even more impressed that these specific proposals on the functions of the agency are the result of a cooperative effort on the part of all the other nations.

KREMLIN'S INACCESSIBILITY REDUCES HOPE OF ACTION

But the channels of communication with the Kremlin seems to be hopelessly slow and even in some cases obstructive. Throughout the preparation of these specific proposals the Russian delegates have taken every opportunity to enter in the record accusations that the preparation of the proposals has not been carried out in accordance with agreed-upon procedures. These accusations are without basis, as the summary record of the United Nations Secretariat will show. But they undoubtedly go back to Moscow and may well be read more eagerly than the lengthy detailed records of the proceedings themselves. In any event, the complete inaccessibility of the Kremlin makes for infinite delays in removing these elements of Russian distrust which stand in the way of a satisfactory agreement.

Foundation Bill and The President's Veto

(*Continued from Page* 290)

for proper administration. Neither could the director be held responsible by the President, for he would be the appointee of the Foundation . . . In the case of the divisions and special commissions, the lack of accountability would be even more aggravated.

"The members of the Foundation would be authorized to appoint the full-time administrative head of an important agency in the executive branch of the Government, as well as more than 70 additional part-time officials in whom important governmental powers would be vested. This represents a substantial denial of the President's appointing power, as well as an impairment of his ability to see that the laws are faithfully executed.

"The ability of the President to meet his constitutional responsibility would be further impaired by the provisions of the bill which would establish an Interdepartmental Committee on Science. . . . An officer who is not appointed by the President, and not responsible to him, would be the man primarily charged with the performance of functions which are peculiarly within the scope of the President's duties—that is, the coordination of the work of executive agencies."

The President then went on to predict that because of inevitable associations between the part-time members of the Foundations and Institutions eligible for contracts or grants, suspicions of favoritism will arise, thus placing the Foundation members in a vulnerable position. It would be more advisable, he insisted, to give responsibility to full-time government employees, and retain eminent scientists in part-time advisory capacity.

The President ended by saying, "There is no justification in this case for not using sound principles for normal governmental operations. I cannot agree that our traditional democratic form of government is incapable of properly administering a program for encouraging scientific research and education. . . . I hope that the Congress will reconsider this question and enact such a law early in its next session."

THE RUSSIAN DELEGATE'S REPLY TO OSBORN

Andrej A. Gromyko

The following is a condensed version of the statement given to the UNITED PRESS by Mr. Gromyko under the title, "What Actually Takes Place in the UN Atomic Energy Commission", in reply to Mr. Osborn's statement (printed on page 299).

On August 3, the *New York Times* published an article by Mr. Osborn, the United States Deputy Representative on the Atomic Energy Commission, dealing with the state of affairs in the Atomic Energy Commission. The author of this article, instead of revealing the real situation existing in the Commission, has limited himself to the attacks upon the Soviet Union delegation, as if the main reason for slowness is an unyielding attitude of the Soviet delegation.

Such assertion does not correspond to reality.

The Soviet delegation has made quite a few attempts to find basis for agreement, and submitted appropriate proposals to this end. It proceeded from the fact that international control of atomic energy must be established in conformity with those principles which have been defined by the United Nations in the decisions already adopted.

It is known that not all agree with this only correct approach. This refers, first of all to the United States. The Soviet delegation cannot make concessions for the sake of concessions, sacrificing the important principles of the United Nations which it considers to be inviolable.

U. S. DELAYED ACTION ON SOVIET PROPOSALS

The Soviet representatives on the Atomic Energy Commission, during the year 1947, have not made a single request to postpone the consideration of this or that question. On the contrary, the United States representatives have repeatedly made such requests.

I am not going, however, to blame the representatives of the United States, or the representatives of any other country, who express desire to delay somewhat the adoption of a decision or even to postpone discussion of this or that question in order to get better acquainted with them. This is a usual phenomenon in the course of negotiations. But it is difficult to justify several months of delay in the discussion of proposals on the most important questions of control. This cannot be explained only by the fact that the United States representatives have not received appropriate instructions from their Government on particular questions.

Almost at every meeting of the Committees of the Atomic Energy Commission the Soviet delegation demanded the discussion of the substance of proposals which were submitted by various delegations including the Soviet proposals on the questions of inspection and scientific research activities, submitted to the Atomic Energy Commission on June 11.

The United States representatives agreed to begin consideration of these proposals only a few days ago.

The Soviet delegation insisted and continues to insist upon the necessity of discussing all proposals submitted to the Atomic Energy Commission in an official way. The American representatives prefer informal meetings of experts to official discussions. As a result a strange situation was created when, at the latest meetings of Committee 2 the American representatives and the representatives of some other countries were still unable to express official points of view of their Governments on the most important questions of control and inspection.

It is known that one of the most serious disagreements is on essential and urgent tasks in connection with the establishment of international control of atomic energy. In accordance with the decision of the General Assembly, the Soviet Government, first of all, proposes to prohibit atomic weapons by concluding an appropriate convention. Of course, to insure the carrying out of this convention, it is necessary to conclude another convention which will provide for the establishment of an international control organ and other concrete measures.

Objections against the conclusion of a convention on the prohibition of atomic weapons are raised mainly by the United States representatives, who do not conceal that the United States could agree to prohibition of atomic weapons only in case their proposals on control are adopted.

CHARGES U. S. WANTS MONOPOLY OF ATOMIC ENERGY

It is clear that the Soviet Union cannot agree to proposals which insure a position of monopoly for one country to the detriment of the legitimate interests of other nations. This opinion is shared not only by the Soviet Union.

The author of the article deals with the Soviet amendments to the so-called "First Report of the Atomic Energy Commission." He points out that these amendments are not clear. However, the discussion has shown that it is not the question that these amendments are not clear, but that the representatives of the United States do not agree with them. This can be said, for example, about the Soviet amendment which provides the establishment of control and inspection over all facilities from mines to plants for the production of final atomic materials immediately after an appropriate convention is concluded and an international control organ established.

In the discussion of this amendment the United States at first stated that they did not understand it. Later on, however, they were forced to admit that this amendment is not acceptable to the United States inasmuch as it provides simultaneous application of international control and inspection not only to mines but also to facilities for the production of nuclear fuel.

International control of atomic energy would lose its meaning and significance if it did not provide for

the simultaneous implementation of practical measures on control and inspection to all the above-said facilities.

The Soviet delegation has repeatedly pointed out the contradictions which exist between the statements of the United States representatives on their readiness and even desire to establish international control of atomic energy and their position, when the proposals on practical measures and on time of its establishment are discussed.

As soon as the question of time is posed, the United States representatives always either refuse to discuss this question or try to prove that the time for placing facilities for the production of nuclear fuel under control should not be discussed at present. Of course, it is impossible to agree with such conception, if we intend, not in words but in deeds, to establish strict international control of atomic energy.

The author of the article also touched upon the question of "veto". He states: "The Russians say that the veto must apply, but they don't say to what it must apply."

The representatives of the Soviet Union repeatedly pointed out that the "veto" existing in the Security Council cannot operate in the international organ, which will be charged with the carrying out of the functions of control and inspection. Concrete day-to-day functions of the international control organ, in relation to which no "veto" will be applied, should be defined in an appropriate convention.

RUSSIANS BELIEVE U. S. STAND ON VETO VIOLATES UN CHARTER

As to the application of "veto" in the Security Council the Charter leaves no uncertainties on this account. The principle of unanimity is operative in application to all questions of substance having relation to the maintenance of peace. It is not necessary to prove that this principle is also equally applied to questions resulting from international control of atomic energy with which the Security Council must deal. It cannot be otherwise, if we do not want to break the Charter down and to undermine the foundation on which the entire edifice of the United Nations rests.

The divergencies on this question are of the principal character. In connection with this question representatives of the United States have no grounds to blame the delegation of the Soviet Union for delay. Rather on the contrary, justice demands to acknowledge that the party which adheres to the basic principles of the United Nations organization and to its Charter has more grounds for accusation of the party which tries to retreat from these principles and from this Charter.

If an article, similar to the one written by Mr. Osborn had been written not by an official United States representative on the Commission, I could explain the appearance of such an article by lack of knowledge on the state of affairs in the Atomic Energy Commission. But it is difficult for me to understand how an official United States representative, who is well informed on the state of affairs in the Commission could write such an article.

Atomic Power Versus World Security

(*Continued rom Page* 288)

not be exploited at once, this country should keep its facilities in at least a standby condition until the stage was reached when the solution of existing scientific and technical problems would enable this and other nations to establish power plants using denatured nuclear fuels. We might then continue to be the sole source of supply until the demand exceeded the capacity of Oak Ridge and Hanford or until primary plants could be erected in other nations.

This is not an admissible policy. Surely we cannot expect other nations to forego their right to develop atomic armaments if this nation is to preserve intact its capacity to produce atomic explosives. Even to broach such a proposal is to discredit our own good faith. On the other hand, no more convincing evidence of the sincerity of our desire for peace could be afforded than by our willingness not only to dispose of the bombs we have but to demolish our existing facilities for making more as soon as the international agency had established effective controls.

SACRIFICE OF POWER BENEFITS SMALL PRICE FOR SECURITY

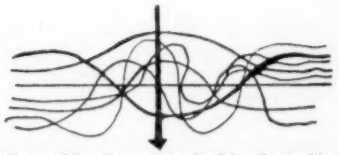
In the light of the available facts, the act of giving up for a time such benefits as may be derived from the power uses of atomic energy appears a small price to pay for the safety of civilization.

Fortunately, there is nothing in the position which this country thus far has taken which would preclude it from now proposing that in the international control plan the stage permitting facilities for the large-scale production of nuclear fuels for power purposes should be postponed until a specified form of further international action had been taken. This permissive action might simply be a determination by the Security Council (subject, of course, to the veto) that the production of nuclear fuels on the scale needed for industrial power would no longer be deemed a potential source of international tension. If, however, it were thought wise to require Senate approval of such a change, the required action could take the form of an amendment to the charter of the international authority; in other words, a treaty.

LET POWER USE WAIT UNTIL WORLD RELATIONS IMPROVE

The way is therefore still clear for the United States Government to attempt the achievement of both atomic disarmament and non-atomic disarmament, without sacrifice to the security of this nation or of the world, by proposing a prohibition of facilities to provide atomic energy for power until a safer stage is reached in the evolution of world organization. If it should do so, the United States would erect a milestone in the progress of modern man as a political animal. The action would represent his first demonstration that he can gear the exploitation of his scientific knowledge to the development of his capacity to govern himself.

GROMYKO REPLIES TO CADOGAN QUESTIONNAIRE



Given here is the full text of Mr. Gromyko's replies to Sir Alexander Cadogan's questions which sought clarification on the Soviet proposals of June 11 (see BULLETIN, Volume 3, Number 8).

Sept. 5, 1947

His Excellency,
Sir Alexander Cadogan,
Permanent British Representative
to the United Nations.

Dear Sir:

In your letter of Aug. 11, 1947, you requested me to answer some questions, submitted by you, in connection with the establishment of control of atomic energy.

Herewith I have the honor to forward to you the answers to your questions.

WILL AGREEMENT ON CONTROL COME BEFORE WEAPON BAN?

The text of the answers follows:

British question (A): *Is it to be understood from the last two lines of paragraph 4, stating that the convention on atomic energy control is to be concluded in accordance with the convention on the prohibition of atomic weapons, that the Soviet Government maintain their view that the prohibition and destruction of atomic weapons must be the subject of a separate agreement to be concluded in advance of any agreement on control? And would the Soviet representative be ready to modify his position to the extent of saying that the first convention, on prohibition, shall only come into force following satisfactory implementation of the second convention?*

Answer to the first question (A): The Soviet Government has considered and continues to consider the prohibition of atomic weapons and the conclusion of appropriate conventions to this end as a foremost and urgent task in the establishment of international control of atomic energy. After the conclusion of a convention on the prohibition of atomic weapons, another convention can and must be concluded, to provide for the creation of an international control commission and for the establishment of other measures of control and inspection, ensuring the fulfillment of a convention on the prohibition of atomic weapons.

DETAILS OF SOVIET INSPECTION PLAN ELABORATED

British question (B): *What is meant by "periodic inspection," e.g., in paragraph 5 (D)? Does it refer to special cases only and does it exclude the notion of continuous inspection in the general field?*[1]

Answer to second question (B): Item 5 (D) provides for periodical inspection of all facilities subject to inspection, from mines to plants for the production of nuclear fuel. Inspection should be of a periodical character both in the general field and in the application to special cases. The inspection of a periodical character should not necessarily imply the carrying out of inspection at regular intervals, fixed before-hand. Inspection can be carried out by the decision of the International Control Commission in compliance with the necessity.

British question (C): *What sort of rules of technical exploitation are referred to in Paragraph 6 (D)?*[2]

Answer to third question (C): Item 6 (D) deals with the rules of technical exploitation which must be established in convention and which must be obligatory for the states. These rules being established by convention should facilitate the fulfillment of control and inspection of plants. The question of the character of such rules of technical exploitation requires special consideration.

If, for example, as a result of progress in engineering there are developed such effective methods of "making harmless" of nuclear fuel which will enable the use of this fuel (for the production of atomic energy) in such a form, that it will be unfit for the manufacturing of atomic weapons, then the application of such methods may be prescribed by the appropriate rules of technological exploitation.

British question (D): *In what circumstances would the "special investigations" referred to in Paragraph 6 (F) be carried out? In other words, what would be regarded as a reasonable ground for suspicion?*[3]

Answer to fourth question (D): In cases when suspicions of violations of the obligations assumed by the states in accordance with the convention on the prohibition of atomic weapons arise, special investigations will be carried out. The grounds for suspicion may be: (1) reports from one or several Governments; (2) conclusions made by the International Control Commission itself. The basis for the conclusions of the latter may be: (A) discrepancy between nuclear fuel available and accounting data; (B) reports by inspectors.

British question (E): *Will the inspectorate be allowed to visit only those plants, the existence of which has been declared by the Government concerned?*

Answer to fifth question (E): Normally, inspectors will visit only declared plants. As to undeclared plants (clandestine activities) this question is covered by the answer to the preceding question (D).

AGENCY RECOMMENDATIONS TO BE ADVISORY, NOT COMPULSORY

British question (F): *Are the recommendations referred to in Paragraph 6 (G) to be purely advisory to governments and with no binding in force?*[4]

1. Paragraph 5 (D) of the Russian proposal says a projected international control commission shall periodically carry out inspection of facilities for mining of atomic raw materials and for the production of atomic materials and atomic energy.

2. This refers to the Russian proposal that while carrying out its inspection the Atomic Control Commission shall "observe the fulfilment of the rules of technical exploitation of the facilities."

3. This provision calls for the control commission proposed by Russia to carry out special investigations in cases when there are suspicions of violations of the convention on the prohibition of atomic weapons.

4. This refers to a Soviet proposal that the control commission make recommendations to governments on questions relating to production, stockpiling and use of atomic materials and atomic energy. Some delegates say that recommendations without binding force would be useless.

Answer to sixth question (F): Recommendations should not have compulsory force in contra-distinction to provisions and rules prescribed by the convention. In case, if experience shows, that the interests of the establishing of an effective international control of atomic energy require that convention be amended with new obligatory rules, then the convention must be accordingly amended and modified.

FURTHER DETAILS OF SOVIET INSPECTION PLAN GIVEN

British question (G): *Does the Soviet Government contemplate "inspection by an international inspectorate" in the sense that the agency's own inspectors, answerable only to the agency or commission, must be admitted to each country?*

Answer to seventh question (G): For carrying out inspection, the International Control Commission must have at its disposal a staff of inspectors selected on an international basis. These inspectors will be accountable only to the commission.

British question (H): *Can the Soviet proposals be interpreted as providing for any forms of control other than inspection?*

Answer to eighth question (H): Besides the prohibition of atomic weapons, the Soviet proposals on the international control of atomic energy provide for:

(1) Inspection and investigation,

(2) Accounting,

(3) Working out and assignment by the commission of the rules of technological control of the plants,

(4) Requesting from governments information relating to the activities of the plants of atomic energy,

(5) Submitting recommendations to governments and preparation of recommendations to the Security Council.

British question (I): *Can the Soviet proposals be interpreted as allowing any further consideration of such controls as supervision, management or licensing as defined in the first report of the Atomic Energy Commission?*

Answer to ninth question (I): No, since supervision management and licensing do not follow from the tasks of the establishment of strict and effective international control of atomic energy.

British question (J): *Should Paragraph 6(H) of the Soviet proposals be interpreted as saying that all measures for the prevention and suppression of violations will be subject to the veto in the Security Council?*

Answer to tenth question (J): Item 6(H) of the Soviet proposals should be understood in the sense that the question of sanctions against violators of the convention on the prohibition of atomic weapons is subject to decisions by the Security Council only. As it is known, procedure of adoption by the Council of decisions on sanctions as well as of other important decisions relating to the maintenance of international peace has been defined in Article 27 of the United Nations Charter.

British question (K): *Does the Soviet Government agree that at least minor sanctions against violators of an agreement may be decided upon by a majority vote either in the commission itself or in the Security Council?*

Answer to eleventh question (K): In conformity with the United Nations Charter decisions on all sanctions can be taken only by the Security Council.

I presume that you will not object to my sending this letter and the answers to your questions, contained herein, to the chairman of the United Nations Atomic Energy Commission (Gen. A. G. L. McNaughton of Canada).

Sincerely yours,

A. GROMYKO

Is There Some Hope for World Government?

(*Continued from Page* 289)

in the realization that atomic energy is not just another secret weapon in the ordinary sense.

When in October 1945, I first introduced a resolution in the Senate proposing that the United States initiate a plan to revise the United Nations into a true supra-national government, not one senator would join me in that action. Nearly everyone with whom I talked thought it was a good idea but they shook their heads sadly and told me that no one else would approve.

Progress has been made in the last two years. When I broached the subject in 1947 numercus senators and congressmen—conservative and progressive—expressed interest. Six senators and ten congressmen joined in introducing a strong measure calling for definite steps to revise and strengthen the U.N.* Ten senators introduced a second resolution milder in tone, but which nevertheless represents an advance in thinking along the lines of effective international action.

With senators and representatives of both political parties and all shades of political belief willing to sponsor such an offer to the world, I believe that the action in itself will help to calm the present wave of hysterical war-mongering which floods the capitals of the world.

*Text given below.

Joint Resolution

(This resolution referred to by Senator Taylor in the article above was introduced as a joint resolution in both houses on July 9 by six senators and ten congressmen.)

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,

Whereas all the people in the world deeply desire durable peace; and

Whereas the United Nations was created as an instrument to preserve the peace of the world; and

Whereas it now is apparent that the United Nations requires strengthening for the full performance of this noble and crucial task; and

Whereas the United Nations Charter in its Article 109 provides a procedure whereby the Chapter of the United Nations may be revised and amended: Now therefore, be it

RESOLVED, by the United States Senate, the House of Representatives concurring, that it is the sense of the Congress that the President of the United States should immediately take the initiative in calling a General Conference of the United Nations pursuant to Article 109 for the purpose of making the United Nations capable of enacting, interpreting and enforcing world law to prevent war.

REPORT ON DOMESTIC DISTRIBUTION OF RADIOISOTOPES

The first shipment of radioisotopes for use in private research was made a year ago. The following is a condensed version of the report, released on August 3 by the United States Atomic Energy Commission, covering its domestic distribution activities over the past year. The Commission's report on foreign distribution appears on page 309.

On August 2, 1946 the first sale of a radioactive isotope produced from the uranium chain-reacting pile of the Clinton Laboratories marked the initial step in the development of peacetime applications of atomic energy.

The Atomic Energy Commission reports that in the first year of production, Clinton Laboratories has made 1,092 shipments of radioactive elements to scientific and industrial research institutions throughout the continental United States and the territory of Hawaii.

* * *

Before the chain-reacting pile was available, radioisotopes were made in cyclotrons. The cyclotron, however, was capable of producing only limited quantities of radioactive materials. The estimated cost of cyclotron-produced C-14 was $1,000,000 per millicurie against the present price of $50 for the same amount manufactured in the pile.

The usefulness of the radioisotopes lies in the fact that while they are chemically identical with the stable forms of the elements, they are radioactive. Thus a minute quantity of one of these isotopes can be followed through complicated chemical reactions, through the metabolic process in the body, through entire biological cycles or through other physical or chemical processes and still be identified. Dilutions or chemical changes of the "tracer" isotope make no difference. The radioactivity will still register on a Geiger counter or show its course on photographic film. The atoms are "tagged" for as long as the radioactivity lasts.

* * *

Allocation of the materials by the Isotope Branch of the Atomic Energy Commission is based upon the recommendations of an Advisory Committee on Isotope Distribution Policy and such matters as the requestor's facilities, nature of research, and whether or not results of the work will be made public. Priority is given those institutions performing work of a purely scientific nature which can be made available to other researchers. All requests for radioactive materials to be used for medical study are referred to a committee on human applications composed of physicians and scientists not connected with the Atomic Energy Commission.

TRANSPORTATION AND HANDLING

Radioactive substances are shipped by common carrier in specially constructed containers weighing from less than a pound to a ton. The average container, such as used for shipping the radioisotope of Iodine (I 131), weighs between 100 and 150 pounds.

The radioactive material is first placed in a glass bottle which is inserted in an air-tight stainless steel cylinder. The cylinder, in turn, is placed inside a lead shield which is supported firmly inside a strong wooden box. Complete directions for opening the lead shield are placed inside the box which is then sealed for shipment. The box is finally checked with sensitive radiation instruments to determine the amount of radiation at the surface. Should this prove to be above tolerance, the substance is repacked with a thicker shield.

One of the largest shipments of radioactive material was in February, 1947 when a 23 gram unit containing radioactive cobalt (Co 60) was shipped to the Bureau of Standards in Washington. The container, shielding the cobalt oxide which was equivalent in weight to a fifty cent piece, weighed 1600 pounds. This isotope which has a half-life of 5.3 years is being used by the Bureau to furnish radiation standards to research workers for calibration of radiation measuring instruments.

Some of the most important radioisotopes for fundamental research in medicine have especially short half-lives. These include radiogold (2.7 days), radiopotassium (12.4 hours), radiosodium (14.8 hours), radioiodine (8 days), and radiophosphorus (14 days).

Shipments of these materials are handled as expeditiously as possible. When a shipping date has been set, arrangements are made with an airline agency and the shipment is sent by fast truck to the airport just before flight time. The customer is advised to meet the plane at its destination and arrange for prompt delivery.

Although during the past year, radioactive substances have been shipped more than 700,000 miles by regularly scheduled airlines, some airlines still refuse to handle them. The radiation intensity at the surface of an isotope container is, however, approximately the same as that at the radium dial of the pilot's wrist watch.

The transportation of radioactive materials is a new problem for the carriers, who are generally unacquainted with the properties of the materials. The Railway Express Company, however, has had rules in effect since 1939, covering the transportation of radium and the express company has handled many shipments which have given off much more energy, in the form of gamma rays, than most of the isotopes which are presently being shipped from Clinton Laboratories.

The Chief Inspector of the Association of American Railroads has advised that the labels, marking and

packing as prescribed for radium should also apply to the transportation of radioactive material.

The airlines established emergency rules effective June 6, 1946, to allow air transportation of radioactive materials until such time as more complete rules could be promulgated. Not all airlines consented to accept shipments. All lines serving Knoxville—Delta, Capital and American—however, agreed to carry materials when consigned by Clinton Laboratories.

Film manufacturers are especially interested in the rules governing shipments of radioactive materials since undeveloped film is the only merchandise which can be affected by gamma radiation.

Because photographic film can detect radioactivity, specially sensitized film is used to keep check on the amount of radiation received by persons handling radioactive substances. At Clinton Laboratories all persons who may be exposed to radiation are required to wear badges containing special photographic film and a record of the amount of exposure is maintained by the Health Physics Department. As an additional service to its customers using radioisotopes, Clinton Laboratories provides film badges so that scientists in other institutions may have check against radiation exposure.

USE OF ISOTOPES IN FUNDAMENTAL RESEARCH

Although radioisotopes have important uses as therapeutic agents in the treatment of certain diseases, their most important role is as a research tool.

The tracer technique, by virtue of the infinitesimally small amounts of chemicals which can be detected through their radioactivity, will enable researchers to study many physical, chemical and biological phenomena which heretofore have remained unsolved.

During the first year, shipments have gone to approximately 170 institutions and researchers in 92 locations scattered throughout the country (many institutions have received a variety of radioisotopes). Approximately 100 varieties of radioisotopes have been made from around 60 elements. (See page 308).

One of the significant benefits accruing from the increased availability of radioisotopes is the fact that students may now be trained in technique for handling such materials. Should an atomic war occur, it would be essential that as many scientists as possible be trained in the technique of working with radioactive material.

RADIOISOTOPES IN MEDICINE

The University of Wisconsin has reported that radioisotopes are being used with great effectiveness in the medical school for investigating the mechanism by which drugs exert therapeutic action.

At Vanderbilt University, Dr. Paul F. Hahn has found radiogold to be exceedingly useful as a means of treating patients with chronic forms of leukemia, lymphoma and Hodgkins' Disease. Hahn estimated that out of 450-odd known isotopes about nine will be useful as therapeutic agents.

At Vanderbilt, 108 patients have been treated with either radioactive manganese or gold for a total of 280 treatments. Forty-seven patients had been treated with cyclotron-produced manganese at an average cost of $92 per treatment. Sixty-one patients have been treated with pile-produced radiogold which cost only an average of $6 per treatment.

Dr. George E. Burch of the School of Medicine at Tulane University has been using radioactive sodium to determine causes and cure of edema in congestive heart failure.

The radioactive sodium was injected into the veins of the patients and blood was collected at rapid intervals —usually from 3 to 5 seconds. At the same time urine was collected from the kidneys. As a result of these studies, Burch found that normally sodium diffused out of the blood vessels at such a rate that 32 per cent of the total plasma sodium escaped in one minute. A complete turnover of all sodium in the plasma occurred every three minutes in normal patients. This indicated that in an average sized healthy man approximately 50 pounds of sodium chloride moved in and out of the blood vessels every 24 hours. In diseased patients, 60 per cent of the total plasma sodium diffused from the blood vessels every minute. In normal patients, 13 per cent of the sodium returned each minute, while in diseased patients, only 7 per cent returned and the balance remained in the tissues.

Burch also found the rate of turnover of water across the blood vessel wall to be approximately 20 barrels a day. Water followed the sodium into the tissues of diseased patients causing edema. This resulted in swollen limbs.

Previous treatment had been based on the administration of a diuretic to eliminate water from the body. Nothing had been done, however, to eliminate the sodium which had caused the accumulation of water. As a result of these experiments, patients are now given mercurial diuretic to eliminate excess sodium.

At the Cedars of Lebanon Hospital in Los Angeles, Dr. Myron Prinzmetal has been using radiophosphorus to compare the circulation of normal hearts with that of hearts afflicted with coronary occlusion. Dr. Prinzmetal has been able to tag red blood cells with this radioisotope so that the extent of circulation can be quantitatively measured. Although it has been known that the heart contained accessory channels which could take over when coronary occlusion existed, this had never before been demonstrated conclusively. Now it was demonstrated that large amounts of accessory channels exist to bring nourishment to the heart muscle when the need arises due to coronary occlusion. "We have also demonstrated," Prinzmetal said, "that there is a continuous blood supply through these collateral channels in all parts of the area supplied by the occluded artery."

Prinzmetal also has been doing research with radioactive iodine in hyperthyroid patients whose afflictions are too serious to make surgical treatment advisable. Prinzmetal treated 15 patients.

The results were surprisingly good and in most cases symptoms of the disease disappeared completely. Since the thyroid gland has an affinity for iodine, the radioactive iodine is collected in the affected area. The radiation emitted by the radioisotope in the thyroid gland provided the therapeutic treatment.

Dr. Edward H. Reinhard, at Washington University's School of Medicine at St. Louis, has used radiophosphorus for the treatment of patients with

polycythemia vera and various types of chronic leukemia.

The radioactive phosphorus, in the form of a solution of sodium phosphate, is given to patients either by intravenous injection or by mouth.

When this radioactive element gets into the blood stream it is selectively withdrawn from the blood by tissues and cells which are primarily involved in polycythemia vera, the leukemias and the lymph node diseases. For example, bone, which is composed largely of phosphorus and calcium salts, takes up from the blood as much or more of the radioactive element than any other organ.

"Most investigators who have used radioactive phosphorus for the treatment of polycythemia vera agree that this is the best form of treatment which has so far been developed for this disease," Reinhard said.

In the treatment of chronic leukemia some patients can be treated most effectively with radioactive phosphorus, whereas in other cases X-ray therapy is most satisfactory. Radioactive phosphorus therapy does *not* permanently cure either polycythemia vera or leukemia, and the treatment must be repeated when the disease again flares up.

Radioactive iron is being used by Dr. Carl V. Moore and his associates at Washington University School of Medicine in the study of anemia. Very small (tracer) doses of radioiron are given and the appearance of the isotope in the red blood cells is a valuable indication of the rate at which these cells are being made by the bone marrow.

The Memorial Hospital in New York has undertaken an intensive research program employing radioisotopes in the study of cancer. Methods have been devised of chemically incorporating radioisotopes in certain drugs such as sex hormones, nucleic acids, and adrenal cortical hormones. Because these substances are utilized by the body in very specific ways, we have available a mechanism of localizing radiation in certain tissues. Nucleic acids are of particular interest because they enter into chromosomes, which are vitally concerned with cell reproduction.

These workers have been able to correlate microscopic structure of thyroid cancer tissue with clinical response to radioactive iodine therapy. From this they can predict whether or not radioiodine treatment is likely to be effective. They have also shown that removal of the thyroid gland increases the uptake of radioactive iodine in widespread secondary growths of thyroid cancer. Another important discovery using tracer iodine reveals that there is a fundamental difference between normal and cancerous thyroid tissue. The drug thiouracil blocks the absorption of iodine in a normal thyroid, but apparently has no effect on iodine absorption in cancer of the thyroid.

RADIOISOTOPES IN BIOLOGICAL STUDIES

Dr. Orlin Biddulph, Professor of Botany at the State College of Washington has been using radioisotopes to study the pathway and mechanism of their movement in plants.

Biddulph is utilizing radioactive iron to study the use of that element by plants. He has found that under certain conditions, phosphorus may accumulate in or on the surface of the root in plants and form an effective block to the uptake of iron. Unblocked roots may deliver to the leaves in a 48 hour period comparatively large quantities of radioiron, while blocked roots may deliver almost none. Since iron is required in leaves as a catalyst used in the formation of chlorophyll these studies are revealing some of the conditions responsible for plant chlorosis, a condition which results annually in millions of dollars of loss to commercial fruit growers.

Dr. George O. Burr and his group at the Experiment Station of the Hawaiian Sugar Planters' Association in Honolulu have been using tracer radiocarbon 14 to study the production by plants of sugars and carbohydrates.

Radiocarbon dioxide was fed for one hour in full sunlight to a leaf of a large cane plant. The plant was harvested three days later and activity analyses made of various chemical fractions of each joint, leaf, and sheath. The growing tip and roots were also studied.

The results were very striking in showing a large amount of new sugar, even in the oldest joints of the plant. As was to be expected the growing tip, roots and youngest leaf received the largest amounts of radiosugar. In only a few of the old leaves was it possible to detect any radioactivity.

Dr. Burr's group has also been using radiotracers to study the action of fertilizer and various agents in the growth of the plants.

Dr. R. E. Dyer, Director of the National Institute of Health of the United States Public Health Service found that radiosulphur can be biologically incorporated into crystalline penicillin. By using radioactive penicillin the drug can be traced through the body.

The institute also is using radioisotopes to tag bacteria. Researchers are studying tuberculosis by tagging the bacillus with radiophosphorus.

INDUSTRY UTILIZES RADIOISOTOPES IN RESEARCH

Although highest priority in the allocation of isotopes was given to the institutions performing research in the medical and biological sciences, Clinton Laboratories has been able to fulfill all feasible requests by industrial applicants as well.

Dr. John T. Burwell, Jr., of the Massachusetts Institute of Technology has been performing experiments in friction. Steel that has been made radioactive in the pile is being used to determine what happens to metal during friction and wear.

Tests at the Massachusetts Institute of Technology have shown that the tracer method makes it possible to detect as little as one hundred-billionth of an ounce of metal transferred from one surface to another by friction. This sensitivity is thousands of times greater than that of previous methods.

The application of radioative isotopes to oil-well logging is now a highly developed science. Sometimes it is necessary to close off perforations in a section by "squeeze" cementing, because encroaching waters reduce oil productivity and make further operation unprofitable. If radioactive material is mixed with the cement, a gamma-ray detecting instrument, when lowered into the well, will give an accurate log of the vertical distribution of cement. Another application is the location of permeable zones. This is accomplished by incorporating radioactive material into the drilling

mud and by forcing the mixture into the formation. A gamma-ray log will then define the oil-rich permeable strata.

In 1941 it was found that the detecting instrument can be made highly versatile by adding a neutron source to the bottom of the cylinder. Neutrons can be produced by irradiating one of the light metals, like beryllium, with alpha particles. Radium is usually used for the alpha-ray source.

Neutrons irradiate the materials surrounding the bore hole of the well, causing them to emit gamma radiation, which in turn is detected by the gamma-ray instrument. The response of the detector is inversely proportional to the amount of hydrogenous materials, such as oil and water, within range of the neutron radiation. Neutron logging will distinguish between sandstone and limestone and makes possible the identification of porosity in formations. It thus gives an accurate picture of the strata encountered.

By means of radioisotopes metallurgists are studying such problems as the aging of ferrous materials by following the diffusion of carbon atoms, the thermionic activity of filaments, and the absorption of gases in metals.

AVAILABLE RADIOISOTOPES

(Radioisotopes available for foreign distribution are indicated by an asterisk.)

*Antimony 122
*Antimony 124
*Antimony 125
*Argon 37
*Arsenic 76
*Arsenic 77
Barium 131
Bismuth 210
*Bromine 82
Cadmium 109
Cadmium 115
*Calcium 45
*Carbon 14
Cerium 141
Cerium 143
Cesium 131
Cesium 134
*Chlorine 36
Chromium 51
*Cobalt 60
*Copper 64
Element 61, 147
Element 61, 149
Europium 154
Europium 155
Gallium 72
Germanium 71
Germanium 77
*Gold 198
*Gold 199
Hafnium 181
Indium 114
*Iodine 131
Iridium 192
Iridium 194
*Iron 55
*Iron 59
Lanthanum 140
*Mercury 197
*Mercury 203
*Mercury 205
Molybdenum 99
Neodymium 147
Neodymium 149
Nickel 59
Osmium 185
Osmium 191
Osmium 193
Palladium 103
*Phosphorus 32
Platinum 197
Platinum 199
Polonium 210
*Potassium 42
Praeseodymium 142
Praeseodymium 143
Rhenium 186
Rhenium 188
Rhodium 105
Rubidium 86
Ruthenium 97
Ruthenium 103
Samarium 153
Scandium 46
Selenium 75
*Silver 108
*Silver 110
*Silver 111
*Sodium 24
*Strontium 98
*Sulfur 35
Tantalum 182
Technetium 97
Technetium 99
Tellurium 127
Tellurium 129
Tellurium 131
Thallium 206
Tin 113
Tin 121
Tin 123
Titanium 51
Tungsten 185
Tungsten 187
Yttrium 90
*Zinc 65
*Zinc 69
Zirconium 95

An important addition to the family of salable isotopes was made on May 1, 1947, when heavy hydrogen (deuterium) was made available for the first time in relatively large quantity. Policies as to price and method of distribution are much the same as for the radioactive isotopes. Prices range from $0.80 to $1.00 per liter of gaseous heavy hydrogen. There is every indication that heavy hydrogen, like radioisotopes, will be put to important uses in nearly every branch of chemical, biological, and medical research. At present the Stuart Oxygen Company of San Francisco, California, is the Commission's only authorized distributor.

The cost of producing these radioactive and non-radioactive isotopes is a very small fraction of the cost of the atomic energy program as a whole; but the value of the benefits is incalculable.

AGRICULTURE

At the Bureau of Plant Industry, Division of Soils and Agricultural Engineering (USDA), radiophosphorus is being used to study the action of phosphate compounds in the soil. These experiments have progressed to the point where field studies will be made this summer. Radiopotassium, radiorubidium and radiocalcium are being used to study the soil chemistry of potash, in particular the storage of potash in the soil. The radioactivity of the elements will make it possible to follow the movement of these materials into plants.

The ancient practice of liming soils is to undergo restudy at Cornell University using radiocalcium as a research tool.

At the Ohio Agricultural Experiment Station, Wooster, Ohio, radiophosphorus and radiochlorine are being used in studies on the movement, accumulation, utilization and distribution of phosphate and chlorine in the growing plants.

At the Department of Agriculture Research of the American Smelting and Refining Company, Salt Lake City, Utah, investigations are being made on the significance of sulfur in the growth and development of plants. Radioactive S 35 is being used to follow the movement of sulfur and sulfur compounds in the plants and the production of plant materials containing sulfur. Radioarsenic is also being used to study the effect of small amounts of arsenic in the soil upon the plant growth and development.

At the University of California radiosulfur is being used to study the synthesis of sulfur-containing protein material by plants. Radiozinc is being used to study the influence of a number of zinc compounds upon the growth and general response of plants to the activity of their hormones. The Bureau of Agricultural and Industrial Chemistry of the USDA is using radioiodine to study the formation of plant hormones containing iodine. The amount of the materials involved is so small that it is impossible to make analysis using ordinary chemical techniques. Radioisotopes permit the study of problems in which the substance being traced is diluted by a factor of a million or more.

Photosynthesis, although basic to the food supply of both plants and animals, is little understood. By this means energy from the sun is stored in carbohydrates to be used as food by both plants and animals. Radioisotopes, particularly Carbon 14 in the form of carbon dioxide, are being used to study the mechanics of this process at the University of Chicago; C. F. Kettering Foundation for the Study of Photosynthesis (which is also employing radioiron in their studies); Experiment Station of Hawaiian Sugar Planters' Association; University of California; University of Pennsylvania; and California Institute of Technology.

WORLD DISTRIBUTION OF RADIOISOTOPES ANNOUNCED

The announcement that the United States will make radioisotopes for medical and biological research available to users outside of the United States was made in a telegraphic message from President Truman to the Fourth Annual Meeting of the International Cancer Research Congress.

The message said, " . . . I want to advise you that it is now possible for the United States to take an important forward step toward greater international cooperation in the field of medical and biological research. On behalf of the people of the United States I am pleased to announce to the Fourth International Cancer Research Congress that progress in the production of radioisotopes by the United States Atomic Energy Commission now permits limited distribution to qualified research workers in other countries of radioisotopes principally for medical and biological research. I know that the representatives of the United States attending the Cancer Research Congress share my hope that the open, impartial, and truly international character of medical research will carry over into the realm of other problems of world concern. The sharing by and among all nations of both the means and the results of cancer research will reduce the loss of life and human suffering from disease throughout the world."

The following is a condensed version of the United State Atomic Energy Commission's report on distribution of foreign radioisotopes. See page 308 for list of radioisotopes available.

Since the War Department's Manhattan District inaugurated the isotope distribution program last year, more than 1200 shipments of some 90 isotopes have been made to more than 160 institutions throughout the United States. No security restrictions or restricted data as defined in the Atomic Energy Act of 1946, are involved in the research or therapeutic applications of radioisotopes by the non-governmental institutions receiving them in the United States. In initiating the domestic isotopes program over a year ago, the War Department required that results of the work be freely published and the Commission has continued this policy in the United States and will make the same requirement of foreign users.

The production of isotopes at Clinton Laboratories, Oak Ridge, Tenn., has now reached a point which will make possible a modest program of foreign distribution. All of the isotopes which may now be distributed abroad can be produced by cyclotrons and prior to the war cyclotrons in the United States helped supply the world with the much needed radioactive materials. Because of the cost and time required in cyclotron production of radioisotopes practically none has been produced in this way in the United States since the war except those isotopes which cannot be produced in chain reactors.

AGREEMENT REQUIRED OF FOREIGN GOVERNMENTS

Foreign governments whose research workers request radioisotopes must first agree:

1. To make progress reports to the United States Atomic Energy Commission every six months on the results of the work with the isotopes and to permit publication of the reports.

2. To insure that the radioisotopes are used for the purpose stated in the requests, which must be approved by the Commission prior to shipment in the same manner as domestic requests.

3. To permit qualified scientists irrespective of nationality to visit the institutions where the materials will be used and to obtain information freely with respect to the purposes, methods and results of such use, in accordance with well established scientific tradition.

Laboratories and medical research groups in the United States have indicated a desire to have foreign scientists visit the institutions in this country where medical and biological research with radioisotopes is under way. This, of course, does not apply to the restricted installations of the United States Atomic Energy Commission.

The proposed distribution program has been reviewed and approved by the United States Department of State.

Each foreign government whose research workers want radioisotopes from the United States will be asked to designate a representative in the United States to file requests and receive shipments, make payment within the United States, and upon receipt of the shipments assume responsibility for the safe handling in transit of the radioactive materials. Delivery will be made only in the United States.

The requests must indicate the names and experience of the persons who will use materials furnished, the name of the institution at which they will be used, the purpose of the use, and a description of the health and safety measures to be employed.

Isotopes available for foreign distribution do not include any radioactive materials applicable to the development of atomic energy for military or industrial purposes. No naturally radioactive materials are included, and no isotopes of any element of higher atomic number than element 83 (Bismuth).

Designated representatives of the requesting governments, after registration with the State Department, will forward requests to the Isotopes Branch, U. S. Atomic Energy Commission, Oak Ridge, Tenn. The U.S. Atomic Energy Commission will publish a catalogue for foreign purchasers. It will include detailed instructions for ordering isotopes, price lists, and precautions to insure safe handling. All packing shipping and transportation costs must be borne by the purchaser. Prices of the isotopes will be approximately the same as prices for U.S. buyers.

Critique of National Science Foundation Bill

(*Continued from Page* 294)

trusted the spending of public funds to part-time officers who could not be held accountable for their policies; (3) it would put those part-time officers who were connected with private institutions in a position where they would be suspected of a conflict of interests; and (4) it gave to an Interdepartmental Committee on Science, with the Director of the Foundation as its Chairman, coordinating functions which were peculiarly within the scope of the President's own duties.

These provisions, the President said, would divorce the proposed Foundation "from control by the people to an extent that implies a distinct lack of faith in democratic processes."

The President also pointed out that the Congress had not appropriated funds to the Foundation; that the transfer of funds from other executive agencies would only lessen the amount of research that they could support; and that the veto of the bill would not reduce the amount of support the government could give to science before the next session of Congress.

"We must start with a law which is basically sound," he concluded. "I hope that the Congress will reconsider this question and enact such a law early in its next session."

The President's veto message was a careful, almost a cautious document, that was applauded by such independent newspapers as the *New York Times* and the *Washington Post*. It was based on the essential point of executive responsibility in a democratic government.

ADVANTAGES OF RESPONSIBLE ADMINISTRATION TO SCIENCE

But if he had chosen to do so, the President might have said a great deal more. He could have pointed out that science has far more to gain by an intimate relation with a democratic and responsible system of administration than by an attitude of distrust and suspicion of government. For administration is not necessarily a negative and restrictive force that must be a handicap to the processes of research. The proposed Science Foundation in particular, and science in general, might gain tremendously if there were more mutual understanding between the fields of science and administration.

In particular, a Science Foundation would have a great deal to gain in a positive way from the one thing that the Smith bill sought above all to prevent—a direct and responsible and intimate relation with the Presidency.

BENEFITS FROM CLOSE RELATION WITH THE PRESIDENT

Such a Foundation would not be permanently endowed by the government. It would need to be included each year in the President's budget, and its budget would require appropriations by Congress. Would it want the President each year, as he considered the comparative claims of its budget and those of federal bureaus engaged in direct research, to reflect that it was set up to support nonfederal research institutions and deliberately organized in such a way as to avoid his control?

Potentially, there would be all sorts of conflicts of jurisdiction between the Foundation and other federal agencies engaged in contracting for research. The Foundation might be affected each year by legislation or executive orders organizing or reorganizing the Executive Branch. Would not the Foundation need the President's support in such matters?

Perhaps even more important, the Foundation's own desire to carry out a balanced program would be subject to distortion by powerful pressures. Its military division, for example, might have the support of the armed services and related interests in demanding a larger share of its total appropriation. A reasonably close relation with the Commander-in-Chief might be useful to the Foundation in such a case.

While the Foundation in particular might benefit by a closer relation with the Presidency, it would surely gain the opportunity to be of greater service to science in general. Science has never had a special spokesman in the Executive Branch, because the departments are necessarily organized according to their general purposes, and science is not a purpose, but a process common to nearly all of them. But just as the Budget Bureau, from its vantage point in the President's Executive Office, has helped all the departments improve their systems of financial administration, so a Science Foundation might help all departments improve the quality of their scientific personnel and extend the usefulness of their research. It would have the opportunity to advise the President and the Budget Bureau on the scientific programs of other agencies, or the President and the Civil Service Commission on the methods of recruiting and training scientific personnel—but it could have such an opportunity only if it were in a position of direct responsibility in the Executive Branch.

The flexibility and freedom of expression of the American governmental system give science an unusual opportunity both to contribute in a positive way to public affairs, and to defend itself against improper interference. A scientist in the government service is more free in the United States than in any other country to make his views known to his executive superiors, to legislative committees, and to the people. The Director of the OSRD, for example, was not required by his position to support the President's recommendations on the science legislation, but was free to express his own opinion energetically to the Congress and the public. As long as such a degree of freedom of expression remains, science has its most effective guarantee against regimentation.

GOVERNMENTAL RESPONSIBILITY NO DANGER TO SCIENCE

There is no danger that science, by accepting a position of responsibility to the democratic process, will not be permitted to work with a proper degree of freedom. (The experience of the armed services, which gain a considerable amount of discretion and influence even though under the constitutional command of a civilian politician, is some evidence to that effect.) On the contrary, only by willingly accepting such a position can science justify its request for generous public support, and gain an opportunity to broaden its contribution to the public service and public policy.

BOOKS

ON UNDERSTANDING SCIENCE: An Historical Approach. By James B. Conant. New Haven, Conn. Yale University Press. 1947. 145 pp. Price $2.00.

This book is modest in scope and purpose. Mr. Conant proposes to examine the question of "how we can in our colleges give a better understanding of science to those of our graduates who are to be lawyers, writers, teachers, politicians, public servants, and businessmen." Despite the limitations of subject, the book deserves an audience much wider than those concerned with college curricula. Because of these limitations, a profound topic is put in focus: the social nature and position of science.

SHOULD ASSIMILATE SCIENCE INTO GENERAL CULTURE

Quite in the spirit of the BULLETIN and its readers Mr. Conant sees an urgent need for the better assimilation, in our secular culture, of the special culture of science. The time has passed when it was possible to maintain that the main political function of science was to provide expert assistance to government. Today it no longer seems presumptuous to say that basic matters of American policy are at stake in the decisions of our political leaders respecting science and its uses. Boundary conditions on the actions of these temporary elected leaders are determined by public opinion to the extent it reaches definition; to the extent it does not, national policy lacks continuity and stability, and there is no health in us. Under present conditions and in the future, therefore, a wide understanding of science has become essential.

What kind of "understanding" will meet these requirements? For some generations we have been taught and uneasily believed in what John Dewey calls "the supremacy of method." To the elementary course in logic another has been added informing the student of a number of important topics of scientific methodology under such headings as classification, measurement, correlation, and the rest. The student so informed, it is hoped, will cherish the scientific method and act accordingly. With what accord he will act, deponent saith not. Actually "method" in this empty context is scarcely distinguishable in meaning and peripheral connotation from "virtue." The suggestion arises that we have changed a word but not the process of education. "Virtue" is never disapproved of, and probably the adjective "scientific" makes it few enemies. But with Socrates we may be permitted to doubt the pedagogical competence of its professors.

WHAT KIND OF UNDERSTANDING OF SCIENCE DO WE AIM AT?

Central among the professions of scientific virtue have been those associated with the "need for an exact and impartial analysis of fact." With all deference due an important truism, Conant dissents strongly from the view, dominant in Karl Pearson's *The Grammar of Science*, that the cultivation of impartiality and exactness makes a man understand the culture of science. It's not that easy. "Understanding science" is defined ostensibly as the "special point of view" with which "a man who has been a successful investigator in any field of experimental science approaches a problem in pure or applied science, even in an area of which he is quite ignorant." This statement indicates that the "understanding" we seek is distinguishable from a knowledge of facts or techniques. What we seek is a way of communicating some of this understanding to the layman. To the extent we succeed we have helped him to assimilate the culture of science.

HOW CAN WIDE UNDERSTANDING OF SCIENCE BE ACHIEVED?

How is it to be done? "The stumbling way in which even the ablest of the early scientists had to fight through thickets of erroneous observations, misleading generalizations, inadequate formulations, and unconscious prejudice is the story which seems to me needs telling." Textbooks necessarily obliterate this story; science students learn it not from texts but because they are apprentices. Others can learn it, Conant believes, by an historical study of the Tactics and Strategy of Science. In the following two chapters three historical examples are looked at by way of illustration: The seventeenth century investigation of the vacuum, culminating in the work of Boyle; Galvani and Volta on electricity; and the overthrow of the phlogiston theory following the work of Lavoisier. From these case histories a number of illuminating principles are educed, which are then summarized in the final chapter. This

material cannot be summarized here. It is worthy of close study, quite apart from the special problems of pedagogy it is intended to meet.

One of the important themes running through this essay is the social relatedness of science, arising because of the essential connection of theory and practice. Its dissent from the positivism of Mach and Pearson is coupled with an estimate of science very different from theirs. "Science emerges from the other progressive activities of man to the extent that new concepts arise from experiments and observations, and the new concepts in turn lead to further experiments and observations . . . This dynamic quality of science viewed not as a practical undertaking but as development of conceptual schemes seems to me close to the heart of the best definition." If we grasp this conception of science we will avoid the error of supposing that the growth of knowledge is an exclusively intellectual process. New experience does not come direct from knowledge or theory, but from action, guided in new paths by knowledge and theory. Viewed in this way there is no mystery in the association of physical science and technology. For although they are only loosely coupled, each provides by its growth new means to the other's ends.

CONNECTIONS BETWEEN THEORY AND PRACTICE

Conant's description of science makes clear some of the essential connections of theory and practice, yet avoids the vulgarization of science of which pragmatists and Marxists of doctrinary tendency have been often guilty and not less often accused. Knowledge is knowledge. It must be pursued on its own terms, and may be for its own sake. But the pursuit of science, however motivated, is an historical process, and takes place in dialetical interaction with other phases of social activity. The twentieth century importance of this interaction has given point to the study of its history. There is thus opened up an immense field of historical investigation, which has been cultivated notably by a series of able British writers such as Crowther, Bernal, Levy, Haldane, Hogben, Needham, Childe, and Farrington. Some—though by no means all—of these writers have tended to identify the social import of science with its programmatically practical side, perhaps because in recent years this aspect has loomed so large among the problems of the British industrial economy. This error has opened them to counter-attack, often correct and sometimes petulant, by those who would like to regain the esthete's view of science for its own sake. It is to be hoped that as Americans take up the discussion they will succeed in avoiding these errors and the unrewarding controversy that inevitably follows them. In this respect Conant's book is an exemplary beginning.

INSUFFICIENT CONCERN WITH CONCEPTS IN SOCIAL SCIENCE

In any final comment on this book, one must take account of the tentative and reflective character of its judgments. In a field where half-truths come cheap, this spirit of continuing inquiry is essential. In the same spirit, one may comment on the hesitant and negative attitude taken toward social science. In some passages Conant suggests that the most important activities of those who are called social scientists are "largely of a practical nature", rather than concerned, as science must be, with the self-evolution of conceptual frames. Elsewhere he says that the most eminent social scientists are perhaps really social philosophers. Still elsewhere (in a note) the suggestion is made that what is lacking in the social field is the marriage of these two lines, analogous to the union of artisanship with learning that was the fountainhead of physical science in the renaissance. Beyond this, one is left with a feeling of "someday, perhaps." And this seems not sufficient, in comparison with the book's other virtues. For its main thesis is that understanding science and being scientific are not wholly separable. They are not identical, and this gives the study of the Strategy and Tactics of Science its point. In the long run, however, the assimilation of science must occur at both levels. A reading of the book with this point in mind suggests that its author has left the social field too easily in the hands of those who would limit the practice of science to impartial classification of facts. The physical and social scientists who have faced in the past two years their responsibilities in the atomic age should all agree, it seems, with Conant's dissent; but the implications are positive. For the facts of this age that are crucial are facts that have resulted from actions guided by theory. And the facts that will test the correctness of our analysis of the perils facing the world will owe their being, in part, to actions taken in the light of that analysis. The problems of strategy and tactics that arise here differ, profoundly, from those which Galileo faced; but not immeasurably. His use of the manipulatory experiment is replaced by the effort to set new boundary conditions on political action, through the leadership of informed discussion. Cannot such action be a test of hypotheses, and lead to their self-development? Thanks to the work of pioneers like Galileo, the scientists of today are trained in impartiality. If the social consequences of their work has made them partisan, the life of Galileo may give some reminder that these attitudes are, on occasion, closely connected.

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